LAND AND PROPERTY VALUES

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AN ANALYSIS OF ENVIRONMENTAL IMPACT

R. K. WISHWAKARMA

CENTRE FOR URBAN STUDIES
THE INDIAN INSTITUTE OF PUBLIC ADMINISTRATION
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FOREWORD

The problem of rising land prices is not confined to our cities but is almost a global problem. Nowhere does this appear more critical than in our growing metropolitan cities. The case of Delhi is unique. Apart from certain historical reasons, the rapid urbanisation and technology explosion have brought about massive urban growth. It has become more difficult to preserve environmental quality with the pressure of population, since more people mean more congestion, more urban spread, the need for more goods and services, and a vast network of highways to transport them. And above all, there is the question of the pent up demand for better residential sites and commercial locations because people have learnt to value the convenience of modern housing, transportation, communication and recreation. All these together mean more demand for urban land and, therefore, pressure on urban land prices.

The local tax structure, which depends heavily upon property taxes is tied to urban land prices. The responsiveness of urban real estate market and the kind of local property taxation to changing urban land prices are, therefore, conditioned by the quality of human environment, the level of services, and amenities generated in an area. To explore these relationships and to find out how and in relationship to what 'environmental' and 'amenity' factors (selected for the study) did actual rental value, land value and rateable value vary, this study was undertaken by Shri R.K. Wishwakarma, an Urban Economist of the Institute. He has ventured for the first time in India, as far as we know, into the field of urban property values and taxation to quantify these effects through econometric models. The study with its analytical methods is thus a pioneering one.

I hope this volume will be useful for both urban economists and administrators, academicians and researchers in urban problems.

T.N. Chaturvedi

SEPTEMBER 16, 1980
NEW DELHI.

(T.N. CHATURVEDI)
Director

PREFACE

In growing metropolitan cities of India, the urban land prices have shown an increasing trend since the beginning of planned development. But the increase has been quite sharp, particularly in Delhi, and that too, towards the node with great variation and local 'peaks' which do not show declining trends in urban land prices, rents and densities with distance from the central business district. These variations in rents and prices are most often explained in terms of distance from the central business district and other local 'peaks' and centres of work opportunities, shopping centre, etc. But apart from distance, the variation in the environmental quality of certain areas and well located sites loaded with services and 'amenities' command higher rentals and property values.

Although standards of environmental quality differ from area to area, the population density measured through occupancy rate, the family income, the type of social and economic group and the high urban land prices are also responsible for high rentals and property values. Within the precincts of these parameters of environmental quality, the study has been conceived to explain the 'differentials' and 'gaps' between rental values, land values and rateable values in Delhi during 1977-78; and also, to measure their contribution to know : (*i*) how and in relation to what factors did actual rental values, land values and rateable values vary, and (*ii*) how this variation is useful for policy implications. In addition, the study also throws some light on the trends in the growth of capital expenditure by sectors and by agencies on the various environmental structure of Delhi in relation to the growth of population and income.

The project was undertaken at the instance of Prof. Abhijit Datta, the then Coordinator of the Centre for Urban Studies. It came into action with generous support and prompt sanction of the project by the former Director of the Institute

Shri R.N. Haldipur, now Lt. Governor of Arunachal Pradesh. But the constant encouragement and support that I received from Shri T.N. Chaturvedi, Director of the Institute, has been a source of inspiration in the completion of the work. I express my deep sense of gratitude to all of them.

The field work of the study was taken up in December 1978 and was carried out by Shri Rakesh Gupta, Training Associate and Shri Rajendra Kumar Khanna, Senior Research Assistant in record time. Although Shri Khanna left after the completion of field work and tabulation of data, the active support and cooperation given by Shri Gupta with his searching mind and good qualities of head and heart has contributed to the completion of the project in time.

I have had the benefit of consultations and discussions with Dr. V.N. Misra, Giri Institute of Development Studies, Lucknow and Dr. P. Kumar, IARI, New Delhi. My grateful thanks are to both of them and to Shri Sayed S. Shafi, Chief Planner, TCPO, for the benevolence of his high offices to have allowed his officers, particularly, Shri P.K.S. Nair and Shri V.S. Bhatnagar for discussing the research problem. My grateful thanks are also due to Prof. P.N. Misra, IIM, Ahmedabad for offering useful comments and suggestions and to my colleague Shri G. Jha for carefully going through the script. Mention may also be made of Shri P.C. Bhagi for reading the script at the stencilling stage.

I would like to thank various authorities of the Municipal Corporation of Delhi, New Delhi Municipal Committee, Delhi Cantonment Board, respondent citizens and many others who directly or indirectly helped me and without whose cooperation the study would not have been completed.

The typing load was cheerfully shared by Mrs. Kamlesh Chopra, Mrs. Vimla Soni and Mr. Surendra Pal Sharma. Mrs. Soni deserves appreciation for sharing the main burden of typing load and Mrs. Chopra for transcribing the script. Mr. Joginder Singh and Miss Praveen Bala also gave their support at times I wish to record my thanks for the cooperation that I received from all of them.

SEPTEMBER 18, 1979
NEW DELHI

R.K. WISHWAKARMA

CONTENTS

CONTENTS

1 NATURE AND SIGNIFICANCE OF THE STUDY

ENVIRONMENT, LAND AND PEOPLE

The impact of environment on land and its people covers management of life support systems in human settlements and their habitat for the well being of mankind. Habitat covers the provision and design of all kinds of shelters and structures for the activities of mankind within various community patterns, including transport network, communication and related infrastructural requirements.[1] Well being of mankind includes the provision of opportunities and living accommodation for recreation, leisure, art, and aesthetic and cultural development.

Within these interlocking dynamics, the inter-action of people, place and resources, whether planned or unplanned, generates an activity pattern which increases 'value', 'utility' and 'welfare'. The changing land-use and its structures are analysed and shaped by many environmental scientists, real estate dealers, architects and public administrators for residential housing, commercial buildings, stores and godowns, highways, utilities and services, schools, etc. But their changing pattern decides the locational dynamics of land values and their rentals, which are hardly stable and change very rapidly over time. And so also their product in terms of tax resources, particularly land revenues and property taxes. It all depends upon what is happening to the community and its people, its size and distribution, its activity pattern and technology, and its society and economy.

In rural areas, the demand for farming land is derived from the demand for farm produce; in towns, the demand for land is derived from space requirements which can be varied by structural changes through the allied process of property

[1] *Human Settlements : Emerging Concepts and Issues,* Situation Report 1, Office of the President, Task Force on Human Settlements, Development Academy of the Philippines, December, 1973, p. 4.

development, redevelopment and conversion.[2] In urban areas, as land-use is subject to fewer changes, location is of great importance and advantages and disadvantages of location are more long lasting. In the event of more demand for central sites in urban areas, rentals are bound to increase as there is no possibility of increasing the supply of urban land in the short-run. And the corresponding change in the demand for centrally located sites in the newly developed colonies having spacious sites and services and better amenities of life and quality environment compel the market forces of demand for a more intensive use of the central area. There is an appreciable increase in the spatial extent of the central area through an invasion of demand of the surroundings which increase land values of the most centrally located sites.

SIGNIFICANCE OF THE STUDY

Rentals and urban land values increase with the increase in the quality of environment and environmental preference of the area having services and amenities. People place high priority to convenience and the convenience of the availability of goods and services. They value the convenience and comfort of modern living in terms of housing, transportation, communication and recreation and above all, clean water, atmosphere and earth. These objective notions of higher urban values of life are responsible for misplaced economic incentives in the economic system. The rising trends in urban land prices and property values fail to take into account the environmental damage that the pollutor inflicts on others. Economists call these damages as 'external social costs'. Unless the pollutor is taxed for this, it warps the price structure; and the price structure that takes into account environmental degradation would cause a shift in prices and, therefore, a shift in consumer preference for the area or for the amenities and services.

Variations in land values and rentals from one locality to another and from property to property in the same locality exist because of differences in the price structures, differences

[2]Wright, R.H., "The Property Market-1", *The Architect and Surveyor*, Jan. February 1921-Cf. Paul N. Balchine and Jeffer L. Kieve. *Urban Land Economics*, 1927, p.7.

in structural designs, differences in the levels of income, diversification of land-use and levels of population growth besides other economic factors such as 'accessibility-space-transportation costs' and physical factors which may prevent access to some of the urban services such as water supply, sewerage lines, schools and recreational facilities. All these factors combined with certain 'amenity' factors, such as the nearness of shopping centre, availability of health, educational, and recreational facilities which improve the 'quality' of 'urban environment', are also the factors affecting the growth and variations in rentals and rateable property values.

The land value is a major element in the process of urban growth and allocation of resources; its pattern of growth will condition the direction and dynamics of urban growth vis-a-vis intensity of land-use competition for real estate dealers. Since changes in the structure and pattern of land values affect rentals of the properties within and outside the central business district of an urban area, it does not destroy but redistribute the marginal incrementals in values over different properties in different areas. As such, the rentals (as a proxy for land value) and rateable value of property are floating and shifting overtime in their varying dimensions, and where this float will attain an equilibrium, will depend upon the economic factors of demand and supply of building properties and housing accommodation.

Rentals should generally reflect land and property value alike. But whether the incrementals in land and property values are reflected in the incremental 'rentals' and the 'rateable values' of property, is a crucial problem of enquiry which might help an Administrator/Municipal Commissioner in decision-making. At times, it has been observed that most of the properties valued at several lakhs of rupees are having rateable value of property of a few hundreds or thousands of rupees. There is no evidence of market value incrementals either in 'rentals' of those properties or in their 'rateable values'. In such cases, the benefits of incrementals in values of properties remain concealed and transacted through 'pugree'—a sort of underhand transaction, depriving the public exchequer of its legitimate share. There is no reason to believe that if the market rents are rising and the property values are also rising,

this rise should not be reflected in the rateable value of property. This is a question that deserves serious attention.

Similarly, the indiscriminate and differential assessment of rateable value of property for the same quality of housing structure leads to unequal incidence and burden of property tax. For example, the assessed rateable value of property for the residential MIG (middle-income-group) flats recently constructed and sold by the Delhi Development Authority indicates both vast inter-local and intra-local variations in assessed values. Since the allotment of flats, the assessed rateable value for each owner-occupied MIG flat in Munirka was Rs. 5,400. This valuation was resented by the Resident Welfare Association in the colony and it was reduced to Rs. 2,280. In similar owner-occupied flats in Ashok Vihar, it varies from less than Rs. 2,000 to Rs. 4,020 and within the locality, it varies from less than Rs. 2,000 (Phase I&II) to Rs. 4,000 and more (in Phase III). Munirka is having more rental value and better facilities than Ashok Vihar Phase-III but the rateable value of the former is less than the latter. Why ? Likewise, in case of Janakpuri, there are four types of assessed values ranging from Rs. 1,400 to Rs. 2,810 and these are now proposed to be increased from Rs. 1,400 to Rs. 2,150; from Rs. 1,800 to Rs. 4,000; from Rs. 2,200 to Rs. 3,000 and from Rs. 2,810 to Rs. 3,240 because of under assessed value of these flats, withdrawal of concessional assessment, increase in rental value of property and better amenities in the area. When there are noticeable differential assessments for the same quality of housing structure, heterogeneous housing structures are prone to more differential assessments. Hence in view of this heterogeneity in the assessment of rateable value of property, the significance of the study lies in estimating the gap in terms of residuals of rents and prices of land as well as the rateable values.

It is commonly assumed that the housing demand or demand for 'rental' accommodation of any sort is the derived demand for land-space and hence the two gradients (property value and land value) are alike. Of course, poor housing structures located on valuable land and palatial houses on poor land, can also affect the rentals and rateable value of property. But where the enhanced values cannot be realised without demolition of the structure making a huge quantum of land available, the

demand for commercial land tends to be stronger in or close to the central business district (CBD)[8]-or sub-nodal points, the benefits of the enhanced property value in such cases are difficult to reap and the decision-making authorities have to conform to the political will of the community.

The most interesting feature of the metropolitan cities like Delhi is that its citizens are witnessing a most costly life style, a clear manifestation of the high income groups gaining respect through possessions and acquisition of things of wordly pleasure. In Indian context, it is not true that people with lower income live in or near the centre of the city rather it is the high class community—a phenomenon of increasing neighbourhood thereby increasing the property values. Centrality plays a dominant role in urban Delhi insofar as the residential accommodations are concerned.

Another interesting feature is the high mobility of traffic—*i.e.*, movement of people and goods and services by private vehicles or by mode of mass transit, has enabled the urban sprawl and concentrated scatterization of urban development. And at the same time, the growth of mass transit has made it possible for people to live in one place and work in another. The limited success in developing mass transit has led to urban growth and suburban development of Delhi and its transport network over the years has grown and developed to perpetuate this pattern by its multi-directional link to all the focal points and suburban sprawl from the heart of the city.

It is evident that the multi-directional growth of urban Delhi has touched upon the land-use vis-a-vis the nucleation of complementary land uses affecting the land value and the value of built-up properties. The interaction of these factors with income, the population mix, the availability of transport facilities with those of social and economic infrastructure together determines the pattern of land-use and urban growth

[8]Central business district is the focus of intra-city transport routes with maximum accessibility to most part of the urban area. In these areas competition for sites among commercial users raises land and property values and the intensity of development to a peak. Increase in population and economic growth increases vertical development of the area adding more density of capital per unit of space. Connaught Place in Delhi is the CBD of the Metropolis.

and design. With the growth in population size, incomes and trade and commerce in suburban and peripheral areas have been connected to the CBD (Central business district) boosting land values reflecting the scarcity of land in the centre. And, with the land value hike, trade and commerce, industries and housing, to some extent, have moved out seeking cheaper land in the outer skirts of the metropolis. High rise buildings in the centre of the city accommodating more workers in the same limited space, have increased the intensity of land-use, and at the same time, the density of capital per unit of space by producing more community services.[4] The uneven effect of the centrality with the improvement in community services and mass transit system also affects land value changes in the suburban areas and peripheral developments.

An apparently complex but basically simple working of economic forces through the land-use pricing process moulds urban design and distribution of its impact. "While it is by no means certain that all urban land rises in value, after allowing for inflation, it is certain that with a growth in incomes and/or numbers and especially if both occur, the land of metropolitan area as a whole rises in value relative to prices in general...This rise is a reflection of the fact that the land yields a rent, that is, individuals will pay more for it because of its scarcity value.[5]"

The appreciation of rent that the land commands on the market is often regulated at customary or conventional levels rather than at market values. In the monopolistic land market of Delhi, the private value exceeds the true social value of land. In the sale and purchase of land, the capital value reflects the risks of gaining the future rents as land value is capitalised value and rental value is certain percentage of the capitalized value. This suggests for a true estimate of gains and appropriation of value. At the same time, suggests for a more valuable use—an important factor for policy options in decision-making.

The increase in the value of a piece of land or property is affected by the decision of the public authority. To improve

[4]Mahesh Chand and R.K. Wishwakarma, "Urban Land Speculation", *Nagarlok*, Vol. IX, No. 2, April-June, 1977, pp. 27-37.

[5]United Nations, *Urbanization: Some Basic Issues*, ACONE, 70/RPC/BP/1 April 17, 1975, p.19.

the environmental quality, the provision of community services and amenities, direct infrastructural investments, planning decisions, etc., change the land-use, urban form and structure, society and economy. Now these subjective notions of improvement in environmental quality are related to objectively measurable variables and how these variables (environmental attributes) are related to rentals, and property values and how changes in these variables can be used to help formulate policy options, is the main theme of the study.

OBJECTIVES OF THE STUDY

Specifically the study aims at the following objectives :

1. To study the growth and pattern of capital expenditure on different 'environmental' and 'amenity' factors in relation to the growth of population and income;
2. To study the relationship between urban land values and rental values and rateable values and to explain their differentials and gaps;
3. To study how and in relation to what 'environmental and 'amenity' factors did these values vary;
4. To study how these variations measure the contribution of each factor and provide a positive basis for policy options in decision-making; and finally
5. To suggest suitable areas of research for a more comprehensive study.

ENVIRONMENTAL DIMENSIONS

In the light of the objective enunciated in the study, to assess the role of 'environmental' and 'amenity' factors on rentals and rateable value of property is not an easy task and to define its boundaries is still more difficult. The concept of environment encompasses not only the natural elements of air, water and vegetation ranging from its scenic beauty to its quality, but also the habitat, its land-use, its economy and its society. The concept of environment in its simplest possible terminology indicates surroundings, it may be social, economic, physical, natural, etc. "Social environment is people(s) surroundings : human beings and their products, their property,

their groups, their influence, their heritage...There is no one social environment, there are many. Each event, be it the construction of a major facility, a reservoir or power project, proposed legislation, etc. as long as it is at a different place-has its own social environment, its own surrounding."[6] The variables that represent characteristics of the environment of human settlements (rural or urban) are the physical elements and services which provide the material support to these settlements.

The physical components comprising of shelter, the superstructure of varying sizes, shape and density provide security to human being; the social and economic 'infrastructure' with its complex network provide the opportunities of livelihood with an assigned task of carrying people from their shelters to places of work and back as well as in the distribution of goods and services, energy or information over the space. Added to this dimension of economic environment are 'amenities' and 'services'[7] required by any community for the fulfilment of its functions as a social body, such as health, education, shopping, recreation, culture and welfare. The quality of life in human settlements is conditioned by the availability of resources and the quality of these components. Shelters provided with infrastructure and services, constitute individual settlements at different scales—the hamlet, the village, the town, the metropolis, and the megalopolis. Another dimension of infrastructure is revealed by its connection between settlements to networks at the regional, national and international levels. The needs for shelter, infrastructure and services are always there and that is why almost all communities both developed and developing throughout the world are consciously engaged in providing these facilities.

The students of social and economic environment are mostly concerned with physical environment to the extent that people in general have come to value them, use them and require them; and hence attach them a utility function for the welfare of the mankind. Sometimes people fear that their way of

[6]Jain, R.K., L.U. Urban, G.D. Stacey, *Environmental Analysis: A New Dimension in Decision-making*, 1977, p. 56 (s) added.

[7]*Report of HABITAT : United Nations Conference on Human Settlements*, Vancouver, 31 May-11 June 1976, p. 23.

life will be disrupted if the resource base is altered as it shifts the life balance of man—sometimes in favour and sometimes against him.

IDENTIFICATION OF ENVIRONMENT

Identification of environmental factors determining the structure and quality of environment is a crucial methodological problem, since the quality of environment is assumed to have varying response to changing social, economic and technological needs of the society from time to time. The dynamic nature of the factors of location is meaningless without reference to a specific site, particular use, a given environment combined with population upsurge and its growth which enter into the dynamics of the situation by raising the density, occupancy rate, labour force participation rate, pupil-teacher ratios, the per capita income and consumption, putting demand for more community services and amenities, etc., over time. An identification of the factors describing these tendencies and attributes of 'environmental' structure in brief is being discussed in the following paragraphs.

Social Environment

In the identification of social environment an index of social conditions has to be constructed to simulate the combined effects of all the variables for policy moves and for obtaining an accurate read-out of resulting effects on some of the very broad 'social indicators' of urban life, rather than dealing with the specific characteristics of the variables. For example, to give social dimension to the environmental problems, it is necessary to take into account, the index of social conditions represented by the rate of deliquency and crime, drug addiction rate, ratio of welfare to total population, etc., which are the resultant of the social and economic mix of the population groups.

Since the population is a basic social fact, its quality and social status are reflected in income mix of the population and its environmental preference in terms of location. High income people generally live in posh localities in their own house, if they own, or pay higher rentals. The high rental values are

usually found in areas inhabited by the high income groups or people commanding high social status. The environmental quality which imparts social preference for an area reveals the compatibility of resident families. The most favourable climate for social integration and neighbourhood cohesion is a common cultural background and its social and economic status. Thus the : (*i*) total population of the locality, and (*ii*) average monthly family income are the broad factors which constitute the socio-economic environment in this category.

Physical Environment

The physical factors of topography, including geographic and atmospheric conditions are most important factors which condition environment. But the density of population, age of the locality and the house, occupancy rate, land and housing density, the quality of construction and facilities available inside the house are also factors that condition the property values and rentals. Generally high occupancy rate reflects low rent and poor people. The modern architectural excellence in the surrounding homes, nature and planting of shady trees, well kept lawns and open spaces, in addition to modern fittings and fixtures, attracts more rental value. Those in high income groups prefer to pay such premiums of rental value which the market places on such locations.

UTILITIES AND SERVICES

The index of community services is indicated by accessibility to services like municipal water supply, electricity, telephones, sewerage and drainage, and access to health and educational facilities, fire and police protection, street cleaning and lighting, street repairs, etc. A regular supply of services and accessibility to such services in terms of time and space are factors in cost minimization. But the lack of these services or deficiency in the supply of these services is considered as a threat to property values vis-a-vis rentals in that area. Inadequacy of facilities may lead to costly damage and discomfort to the residents of that area. The lower property values in certain localities generally reflect the availability of partial services. The nearness of the community services from residence

improves the environmental quality of the locality and hence the rentals and the market value of properties improve.

URBAN AMENITIES

There is no limit to the list of facilities and amenities in the environmental dimensions of a metropolis. It goes on increasing with an increase in the growth and knowledge of science and technology. There is overlapping generally in the identification of community services and amenity factors. But broad criteria adopted to make a distinction between the two is the accessibility to recreational facilities through the efficient use of services measured in terms of minimum mean access time to and provide more leisure for recreation and the welfare of the society under given technology.

Parks and playgrounds are equally important to all categories of persons irrespective of their area preference. The locational attribute of the nearest shopping centre and marketing facilities for the staples of living are most important facilities. In addition, the hardware and variety stores, a laundry and dry cleaning establishment, a flour grinding mill and a provision stores should be available to residents within the walking distance from the home. Proximity of shopping centre adds both value to sites and rental to properties. Convenience of schooling facilities is a factor in sustaining residential values. Generally, parents of nursery and primary school going children attach high value to locations within easy and safe walking distance from the school.

Within the bounds of the environmental factors as identified above, the provision of housing infrastructural services and amenities should be accepted as the broad 'social' and 'economic' goals of urban development. Since land is a unique asset of urban development and decisions on location and siting of economic activities and investment on social overheads have an ever lasting effect on the growth of urban land values and emerging settlements within the city and its periphery, the pattern of land-use should conform to the long-term goals of the urban community in order to avoid imperfections in the urban land market. To what extent these objectives have been achieved in the context of the rapidly changing environment of Delhi will be examined in the next chapter.

2 ENVIRONMENTAL STRUCTURE AND GROWTH OF CAPITAL EXPENDITURE

URBAN DEVELOPMENT AND URBANIZATION

Although the urban development of Delhi was to take place under the garb of a comprehensive development plan, the capital expenditure on the location and siting of economic activities as well as the timing of infrastructural investment have been growing traditionally on the advice of city officials and the other development agencies involved. The 'urban growth' in terms of increases in population, income, number of jobs or increases in either the quantity or the value of goods and services did not necessarily bring out the qualitative improvements in urban life. With the result, the pattern of 'urban development' does neither explain nor justify the growth of Delhi under a development plan. More so, because the plan enforcement relied so heavily on intuition and ad-hocism in development procedures that it has led to an skewed distribution of expenditure for the benefit of the rich and to the deprivation of the urban poor.

It will not be surprising to note that a sizeable proportion of population (more than two-third) is living in sub-standard environmental conditions in urban Delhi after about a two decades of planned development. Of this, about 13.2 lakh population lives in legally notified slum areas; 5.2 lakh in unauthorised colonies, and 2.5 lakh in urban villages engulfed by the extension of urban limits.[1]

Even after a set pattern of planned urban growth, Delhi witnessed unplanned consequences of such planned growth in the form of slums, squatters and a mass of urban poors. These uneducated, the unskilled and the politically weak urban poors, are the most to suffer the consequences of urbanization. To comprehend the grave consequences of poverty, one must tackle the problem of urban unemployment. For, this has given

[1] Jha, G., "Relocation of Squatters in Delhi : Quest for a Policy", Paper presented at the Seminar on *'Control of Urban Building Activity'*, organised under the auspices of Centre for Urban Studies, Indian Institute of Public Administration, New Delhi, March 20-21, 1978.

rise to tremendous inequities and growth of collective 'disservices' and 'disbenefits' associated with deterioration in the natural and human environment. And urban Delhi has reached to a state where the 'pauperization' of moral and social values and their degredation have led to the operation of the "law of social diminishing returns".

ENVIRONMENTAL STRUCTURE : DIMENSIONS AND GAPS

With an area of 446.3 sq. km. and a population of 3.647 million, as of 1971, urban Delhi presents a chaotic mixture of activities and land-uses and suffers from extreme overcrowding and congestion. New Delhi is characterised by spacious and green vistas and by an uneconomic use of land lacking compactness and social cohesion. Then there are refugees and relocated colonies and others, planned and located haphazardly in the south and the west, and some squatter settlements mushrooming here and there on public lands, devoid of urban facilities often without utilities and services. All these present a true manifestation of the structure of human environment[2] in urban Delhi.

The demographic upsurge has given an impetus to some of the environmental factors. The index of population growth (taking 1901 as the base year = 100) has recorded an increase of 1102 in 1961 and 1963 in 1971 and the corresponding growth in area was 775 in 1961 and 1019 in 1971.[3] Consequent with an increase in population the social composition of urban Delhi has become adverse with a sex-ratio of 799 females per 1000 males. It is another source of moral degradation and social deprivation.

Urban Delhi accounts for 0.729 million census houses and 0.599 registered houses. The mean number of households varies from 1.05 to 1.23 and the average household size from 4.46 to

[2]Government of India, Town & Country Planning Organisation, *Review of Master Plan for Delhi*, February, 1973 (Mimeo.) pp. 1-2.

[3]Wishwakarma, R. K., *Land Values in Delhi : An Analysis of Spatial Variations and Trends*, Disseratation submitted for the award of M. Phil Degree in Regional Development, Centre for the Study of Regional Development, School of Social Sciences, Jawaharlal Nehru University, 1972 (typed script)

5.06. Of the total households, 18 per cent of household are without separate houses and an equal numbers without pucca or semi-pucca structures. About 57.39 per cent live in single-room tenements, 25.38 per cent in two-rooms, 9.36 per cent in three-rooms, 4.28 per cent in four-rooms, and 3.59 per cent in six to seven-rooms. This shows an alarming housing situation of maldistribution, congestion, and over-crowding.

The economic structure of urban Delhi is dominated by tertiary sector which accounts for about 69 per cent of the total working force. It is one of the richest union territories in the country with a total net domestic product of Rs. 9966 million (at current prices) and a per capita of Rs. 2,115, as of 1973-74. It has recorded a linear growth of 30.66 per cent in income as against 4.82 per cent in population, during 1970-75.

The environmental goods and services including public amenities and utilities did not keep pace with the growth of its income and population and the gap between the two has widened over time and space. About 40 per cent of its residents "do not get potable water supply and have to depend on sub-soil water"[4] despite a total supply of 230 mgd., as of 1974-75. The annual domestic consumption of water has increased from 760.82 lakhs KL in 1970-71 to 1116.58 lakh KL in 1975-76. The total consumption including commercial and industrial, for the corresponding period has increased from 1,158.63 lakh KL to 1,481.90 lakh. The average monthly consumption of water per connection varies from 38.20 KL in MCD area to, as high as, 76.60 KL in New Delhi Municipal Committee area.[5]

As regards the consumption of electricity, the domestic sector consumes 2,522.23 lakh units or about 56 per cent of total consumption. Commercial sector accounts for 28 per cent and industrial sector only 16 per cent. The average monthly consumption per connection varies from 72 units in MCD area to 107 units in Delhi Cantt. and 126 units in NDMC area.[6]

[4]Misra, Girish K. and K.S.R.N. Sarma, *Distribution and Differential Location of Public Utilities in Urban Delhi*, Centre for Urban Studies, Indian Institute of Public Administration, New Delhi, 1979, p.75.

[5]*Ibid.*, p. 78.

[6]*Ibid.*, p. 94.

Insofar as the means of transportation are concerned, there has been tremendous growth both in traffic and transport. The number of cars has increased from 61,521 to 86,668, motor cycles and scooters from 1,08,112 to 2,04,594, auto-rikshaws from 10,812 to 15,836, taxies from 4,108 to 5,973, buses from 3,266 to 5,311 and goods vehicles from 15,262 to 23,839 during the period from 1971 to 1975. In addition to this, the growth in slow moving vehicles such as bulluck carts and hand driven carts increased from 12,301 to 13,548. The fleet of public transport has increased from 1,288 in 1971 to 2,245 in 1976-77 with an average number of buses daily on road from 870 to 1,629 and the average number of passengers from 7.36 lakhs to 18.40 lakhs daily. These have an important bearing on the land economy of urban Delhi in terms of growth in capital expenditure on infrastructural investments.

GROWTH IN CAPITAL EXPENDITURE

With the growing concern for environmental structure and its improvement, there has been tremendous growth of capital expenditure on social overheads. In Delhi during the period 1970-75 alone, a sum of Rs. 2,843.882 million was spent as capital expenditure on different heads such as land and housing, transport, electricity, water supply and drainage, roads and bridges, telephones, slum improvements, shops and market establishments, parks and playgrounds, public safety and conveniences, buildings, etc.[7] An analysis of growth rate in capital expenditure (Table 1) reveals that the overall linear[8] growth was 7.51 per cent as against exponential growth of 6.25 per cent. The exponential growth of population was 4.21 and that of income 15.57 per cent.

An analysis of linear growth rates in capital expenditure shows that the expenditure on social welfare, transport (rolling

[7]Datta, Abhijit, *et al*, *Organisational Framework for Metropolitan Planning and Development : Preliminary Report of City Surveys*, Indian Institute of Public Administration, New Delhi and Indian Institute of Management, Calcutta, June 1978 (Mimeo.).

[8]Calculated by fitting the function of the following form : $Yt = a+bt$ where, the b coefficient multiplied by 100 gives simple linear growth rate over time.

TABLE 1 GROWTH RATES OF POPULATION, INCOME AND CAPITAL EXPENDITURE IN DELHI, 1970-75

Variables	*Growth Rates*			
	Linear	R^2	*Exponential*	R^2
Population[1]	4.82	.9593	4.21	.9391
Income[2]	30.66	.9158	15.57	.9612
Expenditure Heads[3]				
Social Welfare	414.91	.8859	31.79	.9433
Transport (Rolling Stock)	395.62	.3347	17.27	.1501
Transport (Fixed stock)	116.51	.3887	37.70	.4254
Telephones	111.33	.4531	19.19	.3997
Water Supply	27.70	.4497	16.57	.5216
Electricity	21.89	.9269	13.46	.9207
Drainage	18.81	.6362	11.01	.6697
Shops, Markets and Commercial Estt.	−7.25	.1573	−9.17	.1428
Land Development	5.44	.0655	3.50	.0450
Building	−5.40	.3075	−5.09	.3307
Road and Bridges	2.59	.1124	2.20	.0927
Slum (J.J. Colonies)	−0.71	.0006	−3.56	.0177
Parks & Playgrounds	−1.20	.6762	−16.65	.6816
Staff Housing	−1.56	.0059	−3.56	.0206
Public Housing	−3.04	.0315	−3.09	.0275
Public Safety	−11.26	.2141	−33.27	.3869
Slums Development	−20.42	.6950	−4.16	.8341
Miscellaneous	−2.98	.3021	−3.45	.3204
Overall growth	7.51	.4542	6.25	.7778

NOTE : Data source for computation of growth rates :

[1] [2] Bureau of Economics and Statistics, Delhi Administration, *Statistical Book of Information* 1977.

[3] Abhijit Datta, *et al*, *Organisational Framework for Metropolitan Planning: Preliminary Report of City Surveys*, Indian Institute of Public Administration, New Delhi and Indian Institute of Management, Calcutta, June 1978 (Mimeo).

stock) was about four hundred per cent and above, followed by transport (fixed) 116.51 per cent and telephones 111.33 per cent. The corresponding growth in capital expenditure on water supply, electricity, drainage, etc., was quite high. Roads and bridges and land development noticed a very nominal growth rate. But high negative growth rate is indicated in case of slums (development) and public safety; while low negative

growth rate is witnessed in housing, slum improvement, (J.J. Colonies) parks and playgrounds, buildings, etc.

The positive and negative and high and low growth rates are indicated by the explanatory power of the model R^2. The coefficient of determination R^2 in case of income and population growth is as high as 96.12 per cent and 99.91 per cent respectively. It varies between 83.41 to 95.33 per cent in case of social welfare, electricity and slum development.

ELASTICITY OF GROWTH WITH RESPECT TO POPULATION

The elasticity[9] of growth of capital expenditure with respect to population was positive (Table 1) in case of transport, social welfare, telephone, water supply, electricity and drainage, all above unity in descending order; and negative in case of buildings, shops, markets and commercial enterprises, parks and playgrounds, public safety, slum development, all above unity in ascending order. The overall elasticity of growth of public expenditure with respect to population was 1.4845.

GROWTH OF CAPITAL EXPENDITURE BY AGENCIES

An analysis of the exponential (Log Linear) growth rate in capital expenditure (Table 2) incurred by different public agencies during 1970-75 indicates positive high exponential growth rates ranging from 15 to 25 per cent and above in case of Railways, DTC, DESU and DWS & SDU all in descending order. While the expenditure of Delhi Development Authority grew at the rate of 2.28 per cent, Public Works Department of Delhi Administration, Delhi Cantonment Board, the Municipal Corporation of Delhi, Central Public Works Department and New Delhi Municipal Committee have shown negative growth rates in capital expenditure over time.

GROWTH ELASTICITY OF CAPITAL EXPENDITURE WITH RESPECT TO POPULATION, INCOME AND PER CAPITA INCOME

In order to analyse the relative change of capital expenditure by different public agencies, Cobb-Douglas function was

[9]The elasticities have been calculated by fitting the function of the form $Y = ae^{bt}$ (Log Linear function) $\text{Log } Y = \text{Log } a + bt$ where, Log 'a' indicates pure intercept and coefficient 'b' the elasticity.

TABLE 2. GROWTH TRENDS IN EXPENDITURE INCURRED BY DIFFERENT AGENCIES IN DELHI DURING 1970-75

Agency/Govt. Deptts.	*Exponential Growth Rate*
Railways	27.23
Delhi Transport Corporation	25.73
Delhi Electricity Supply Undertaking	15.63
Delhi Telephones	18.21
Delhi Water Supply and Sewerage Disposal Undertaking	15.01
Delhi Development Authority	2.28
PWD, Delhi Administration	—10.82
Delhi Cantonment Board	—10.27
Central Public Works Department	— 6.54
New Delhi Municipal Committee	— 2.43
Delhi Municipal Corporation	— 1.09

fitted to the data. All the expenditure on capital overheads pooled together indicated elasticity of more than unity with respect to population (Table 3). Expenditure on social welfare, transport (both fixed and rolling stock) and telephones shows positive elasticities above unity with respect to a relative change in population, income and per capita income. Expenditure on water supply, electricity and drainage was also elastic and above unity with respect to population but less than unity with respect to income and per capita income.

The expenditure on public safety, parks and playgrounds and slum improvement, on the other hand, shows negative elasticities of more than unity with respect to population and per capita income. Land development and housing for staff shows inelastic growth indicating thereby discontinuity in capital expenditure with respect to growth in income and per capita income. But this must be examined against the level of development effort which has been made up till now from the base year to have the correct perspective.

IMPLICATIONS

The pattern and growth of capital expenditure elasticities with respect to population and income indicate a relative

TABLE 3 ELASTICITY OF CAPITAL EXPENDITURE WITH RESPECT TO POPULATION, INCOME AND PER CAPITA INCOME OF DELHI, 1970-75

Expenditure Heads	*Elasticity with respect to*		
	Population	*Income*	*Per capita Income*
1. Transport (fixed stock)	8.9422	1.4413	2.2152
2. Social Welfare	7.5364	1.9938	2.3136
3. Telephones	4.5393	1.4413	1.6920
4. Transport (Stock Rolling)	4.0967	1 5229	1.8982
5. Water Supply	3.9312	0.8461	0.6898
6. Electricity	3.1931	0.8268	0.7491
7. Drainge	2.6122	0.7655	0.7118
8. Land Development	0.8309	0.0424	−0.3740
9. Roads and Bridges	0.5216	0.1668	−0.1085
10. Housing (Public)	−0.7341	−0.3485	−0.8539
11. Miscellaneous	−0.8186	−0.2443	−0.6838
12. Housing (Staff)	−0.8433	−0.0912	−0.4023
13. Slums (J. J. Colonies)	−0.9856	−0.6365	−0.3753
14. Buildings	−1.2081	−0.3783	−0.8777
15. Shops, Markets & Commercial Enterprises	2.1747	−0.2919	−0.5966
16. Parks & Playgrounds	−3.9475	−0.9320	−0.5329
17. Public Safety	−7.8888	−2.4948	−3.8684
18. Slum Development	−11.5278	−2.9484	−4.2267
All Heads	1.4845	0.3821	0.1596

importance of priority given to different sectors. This reflects an element of bias towards the growth of services and amenities meant for 'better-offs' only or, to improve the services of the better-off areas alone. There seems to have been no intention of giving additional inputs to new areas but adding more and more to the land and property values of the existing areas. As a consequence, the investment for the creation of new land inventory has been lacking implying thereby a widening gap between demand and supply creating further distortions and scarcity in the urban land market of Delhi. All this happened against the crucial background of regulated use and development of land and its proper exploitation as resource, generating finances for the growth of the metropolis with the provision of necessary infrastructure to ensure against deterioration in environmental conditions.

3. REVIEW OF LITERATURE AND HYPOTHESES

REVIEW OF URBAN DEVELOPMENT

The analysis of the preceding chapter reveals the 'gaps' and 'inequities' in the development efforts to better the quality of life of its people in urban Delhi. It also shows the differentials in distribution of 'services' and 'amenities', lags in the development and disposal of land and imperfections and distortions in the use of land and its market. This process might continue, even further in the wake of political instability and the politics of urban development. The signs of improvement are very dim. The current knowledge known to the planning and development administrator can neither cope up with the situation nor there is a well developed body of 'theory' and 'inventory' of urban data relating to urban development to bring about a desirable change.

Land prices are perhaps the most important determinant of the type and intensity of land-use at specific locations, and, therefore, of the form and structure of our cities. In Delhi, however, the freeze of competitive land market was since 1959 and the operation of the Delhi Development Authority in the development and dispopal of urban land has been a single source determining the directions and dynamics of urban land market, an important element in the growth and development of land and property values. The process of urban development that followed the location of residential households and the construction of private properties, the building of highways, improvement in transit system, as well as imposing of zoning and sub-division controls have increased the land and property values of thousands of people but how much of this private gain has gone to public exchequer is a moot question. Whether these actions are planned or unplanned, public or private, they are bound to affect the value of real estate which will have its consequential effect on city's growth and structure.

It is only through a painful effort that DDA and local governments charged with planned development have been able to learn about the 'economic' and 'fiscal' effects of a

green-belt policy; of land bank; of tax on, or the public acquisition of, development rights and of the reaction in the private housing market to zoning restrictions.[1] The massive economic and social development has brought pervasive and persistent increases in the amount of land devoted to urban use throughout the metropolitan Delhi. Often the property dealers, concerned officials dealing with urban development or controlling land-uses may have a pragmatic sense of what is happening to the city's growth and structure. "But the intricate reciprocal relation between land price and land-use, and the direction and degree of influence of taxation and other controls of the provision of public and private facilities, and general population and economic change remain to be fully explored.[2]" The study, however, is not designed for such explorations but to acquaint with the current knowledge, bringing together the more important information on urban land and property values to evolve a conceptual framework and hypotheses within the given objectives of the study.

CONCEPTUAL FRAMEWORK

The conceptual framework used in the study is based on land value, rental value and rateable value of property as conditioned by 'environmental' and 'amenity' factors. An account of the same is being given below.

Land Value and Rental Value

The concept of 'rent' has received much attention in economic thought for over a century. The classical explanation of the rent arises due to scarce supply of particular grades of land or due to productive capacity of the resource. The payment for the use of the attributes of land is known as commercial rent, but there are two constituents of rent-transfer earnings and economic (or scarcity) rent. The former arises because of the nucleation of complementary uses; while the latter, for the payment of the 'scarcity' component of land or

[1] Grace Milgram, *U.S. Land Prices—Directions and Dynamics*, Research Report No. 13, prepared for the consideration of The National Commission on Urban Problems, p. 9.

[2] *Ibid.*, p. 9.

resource over and above its transfer earnings.

The concept of land value may be expressed as the "monetary valuation of land-use" or property use, a sort of price which may be designated as rent. In urban areas, the demand for land is a demand for space. It may vary with the structural changes through the allied process of planned development, redevelopment and conversion; and hence, this process may give rise to both rentals and values.

Within urban area, land-use is subject to fewer changes; location is, therefore, of greater importance, and advantages and disadvantages of location are long lasting. This generates an element of scarcity of land within the CBD and a high level of demand for central sites will yield high rentals. Yet as urban land is fairly inelastic in supply, economic rent is fairly large towards CBD and its proportion to the total rent also increases towards the centre. Any increase in demand will increase both the economic and total rent since the central locations are accessible ones with convenience in terms of distance-time-space; the pattern of accessibility also creates a pattern of land use which will be concomitant with the pattern of land values.[3]

In the context of our study, the use of the concepts 'property value', 'rental value' and the 'land value' is in relation to residence. The real estate market deals in rights not directly in the land and buildings that are the property objects, but in making lease, the right of possession exchanged for consideration known as 'rent'. The market forces relating to rental space are subject to the same economic factors affecting land and property values. The high ratio of tenancy in rental housing expressed in terms of rent per unit (per sq. ft.) of space (or dwelling unit) is bound to increase rentals and thereby property income.

The relation between land value and rent can be expressed in terms of capitalization of net land rent after allowances are made for all other factors of production and taxes. Here land is treated like any other form of investment whose value is viewed as its annual rental income capitalised at some prevailing

[3] Paul N. Balchin and Jeffer L. Kieve, *Urban Land Economics*, 1927, pp 8-13.

rate of return on investment. In an open market for land "the market value will be the highest price estimated in terms of money which the property will bring if exposed for sale for a reasonable length of time. In particular instances, the market value may include a speculative element due to differentials in individual expectations of buyers and sellers."[4] The basic principle governing the rates of return, either through capital appreciation or rental income will tend to be equal.

RATEABLE VALUE OF PROPERTY

Taxes on property may be assessed in the form of : (*i*) annual rental value system, (*ii*) capital value system, and (*iii*) site or land value system. Under rental value system, tax rate is assessed against annual rental value. The capital value system uses some proportion of the market value of property as the tax base, but land value system is based on the estimated market value of land.[5] "When the real rental stream is known with certainty, there is an exact equivalence between a tax on rents and capital tax. Although formally the same in their incidence, the two types of taxes do have markedly different effects on capital value. The capital tax induces oscillations in the price of land which the rental tax avoids."[6]

The interesting feature of the annual rental value of the property tax system is the definition of base as the 'expected' or 'notional' rental value of property. It is a hypothetical rent for a hypothetical tenant. It poses a great assessment problem with respect to the quality of environment based on structures, architectural beauty, the quality of construction, space area covered, the amenities and services inside, etc., which are heterogeneous in character. The assessed rateable value of property for purposes of taxation largely depends upon the professional skill of the assessors. An account of the assessment

[4]Rao, S. Ananda, "Structure and Growth in Land Values in the Urbanizing Areas of California", *Regional Science Association*, Conference of Arizona State University, 1964-65, pp 20-21.

[5]Bahl Roy, W *Urban Property Taxation in Developing Countries*, World Bank Urban and Regional Report No. 77-5, April 1976 (Draft), p. 6.

[6]World Bank Staff Working Paper No. 283, *Urban Land Policy: Issues and Opportunities*, Vol. 1, May 1978, p. 93.

procedure in Delhi is given in Appendix I. The problem of separating land portion from the total value assessment of the property is not only difficult but also meaningless.

REVIEW OF LITERATURE

In recent years several attempts have been made directly or indirectly on the determinants of urban property values. Evans[7] stresses on distance and accessibility relationship, Kain and Quigley[8] and Wilkinson[9] stress on locational attributes of residential environment and neighbourhood qualities and have developed the theories on land value-distance-function in an attempt to evolve a theory on residential equilibrium. A good 'housing' refers to flow of services with no distinction made between owning or renting. From the maximisation of the utility function subject to an income constraint comes the condition that, in equilibrium, what the household saves from a very short move toward or away from the CBD is offset by change in transport costs.[10] With the exception of Kain and Quigley, in most of the studies, the function was negative and insignificant. But Wilkinson found a positive effect while Ridker and Henning[11] discovered that house prices increased with distance. However Richardson's[12] study results suggest that a positive distance function will become negative if the relation is standardised for income, house type and social class.

Muth demonstrates that the "price distance function satisfying individual households equilibrium conditions must be negative exponential". Adding the assumption of a linear

[7]Evans, E. W., *The Economics of Residential Location*, Mac Millan, 1974.

[8]Kain, J. F. and J. M. Quigley, "Measuring the Value of Housing Quality", *Journal of the American Statistical Association*, June 1970 (b), Vol. 65, pp. 532-548.

[9]Wilkinson, R. K. and Archer, C. A., "Measuring the Determinants of Relative House Prices", *Environmental Planning*, Vol. 5, 1973, pp. 357-67.

[10]Goldstein, Gerald S., "A Survey of Urban Economics" *The Journal of Economic Literature*, Vol. X, 1973, p. 476.

[11]Ridker, R.G. and Henning, J.A., "The Determinants of Residential Property Values with special reference to Air Pollution", *Review of Economics and Statistics*, Vol. 50, 1968, pp. 246-257.

[12]Richardson, H. W., "Determinants of Urban Housing Prices", *Urban Studies*, Vol. II, 1978, pp. 188-93.

homogenous Cobb-Douglas production function for producers, he derives "a density gradient that is a function of price gradient for housing." He further suggests that "housing process, land rents, and densities would no longer decline everywhere with distance from the original CBD. There would be local peaks surrounding other centres.[13]

In theoretical developments, the choice of distance measures has been very wide : linear distance (Brigham 1965), the Logrithmic distance (Anderson and Crocher 1971, Evan 1973), travel time (Ridker and Henning 1968; Wabe 1971), job accessibility measures (Wendt and Goldner, 1966; Lac 1970; pp. 1971).[14] In this study, what has been used is the simple measure of road distance from residence to a defined node CBD, shopping centre and place of work in linear and logrithmic distance functions. Of other measures, the availability of number of buses in an hour from residential localities to different nodal points (directions) of the metropolis, was also used. Property and rental values are expected to be higher in areas having less mean accessible distance with good public transport services.

The economic status defines the social status of man and the social class as a whole as generalised by Homer Hyot and Burges has a positive impact on residential property values and hence on rentals. The family income of the locality as sum of the average family income of the households is a measure of social status of the locality which has been used in this study to reveal the characteristics of a residential property and the utility function of the individual household in terms of the area preference with quality environment.

The economists[15] and environmentalists have advanced the theories that pure accessibility models ignore the real world facts and that property values and their rents and prices are determined not by accessibility alone but by the environmental

[13]Goldstein, Gerald S., "A Survey of Urban Economics", *The Journal of Economic Literature*, Vol. X, 1973, p. 476.

[14]Richardson, H. W., *op. cit.*

[15]Richardson, H.W., *Urban Economics*, Penguine, 1971; Elis, R.H., "Modelling of Household Location", *Highway Research Record* 1967, No. 207, pp. 42-51 ; and Stegman, M.A., "Accessibility Models and Residential Location", *Journal of American Institute of Planners*, Vol. 35, 1969, pp. 22-29.

attributes of the residential locality in which the house is located.

Non-pollution free and unclean environment includes, congestion and overcrowding, noise pollution, smoke and industry, poor quality and old dilapidated structures, etc. A suitable balance between the pollution free and non-pollution free environmental attributes decide the relative price of housing structures, their values and rentals. In this study, I have taken the aggregates of physical environment in terms of density of occupancy rate as a measure of crowding and congestion, access to public utilities and services including amenities in terms of the availability of transport, nearness to shopping centre, CBD and place of work. Most of the scholars have attempted to explain the variation in land and property values within urban areas using measures of centrality, accessibility to local centres other than central business district and various 'services' and 'amenity' factors.

THEORETICAL POSTULATES

The abstract Ricardian logic that explains the relation between rising rents and rising land prices, though a matter of historical accident, is based on the concept of both 'scarcity' and 'value'. Unlike modern monetary measure of value, Ricardian measure of value is neither a price deflator nor it explains the relation of 'high rentals' with those of rising prices. There is an inverse relation between the two. Land prices are high not because rentals are high but because value of land is high. Since value of land includes the "right to benefit services rendered by it", the derived demand for land in terms of housing and an expected high rate of return from rentals can also be associated with the higher urban land values.[16] This theorises to postulate that high rentals are related to high urban land and property values.

The distribution pattern of land values and their differential in some form or the other are related to : (*i*) land-use structure, and (*ii*) the structural attributes of environment, which are heterogeneous in nature. This gives rise to differential rents

[16]Mahesh Chand and R.K. Wishwakarma, "Urban Land Speculation", *Nagarlok*, Vol. IX, No. 2, April-June 1977, pp. 26-37.

in that two homogeneous properties located at different points will not yield an equal rent due to heterogeneity of locations and environmental conditions with respect to the centrality of the node or nearness to the shopping centre. Within the precincts of these theoretical premises, one can postulate that land values and rental values would no longer decline everywhere as we proceed farther away from the central business district.

Land prices and population density gradients with respect to distance from the central business district have generally been used to describe the internal structure of cities. As a substitute of population density, a more sophisticated term—the occupancy rate (density of persons per living room)—has been used in conformity with the environmental structure of the city to hypothesise that urban land values and their rentals decline with a unit increase in occupancy rate.

It is true that certain locations are most preferred not because of their nearness to the shopping centre or central business district but for other 'amenity' factors considered necessary for the inter-action of human activities and mastering space which act as a cost on land value and rental value differentials. To consider this aspect, it could be hypothesised that nearness to place of work from residence is an increasing factor in rental value and both are inversely related. Rents plus transportation cost called by Haig the 'friction of space'[17] tends to balance at each location. But Alonso advanced this theory further by pointing out that space is an independent variable, which must be included with that of closeness to the centre, in a three-way balance of 'accessibility-space-transportation' costs in determining the price of land (or housing) and value of property.

In the absence of data on density of capital per unit of space in different localities and zones of the city, no suitable hypotheses could be formulated to relate land values with rentals and other amenity factors. Nevertheless, the increase in efficiency of space, increases the property value and rental value. The correspondence of economic growth and property values which go hand in hand are reflected in rentals and property incomes.

[17]Haig, Robert M., "Major Economic Factors in Metropolitan Growth and Arrangement", *Regional Survey of New York and its Environs*, New York, 1927, p. 38.

Since investment in land and housing is related to the valuation of property, the success of effort depends upon price paid and the assessment and appraisal of property income, which in a form is akin to investment analysis.

HYPOTHESES

1. Rental value increases with an increase in land value per square metre. There is a positive relationship between rental values and urban land values.
2. Land value increases proportionately more than rental value.
3. Rateable value of property is an increasing function of property value (rental value + land value).
4. Rental value increases proportionately more than rateable value of property.
5. Land and property values (both rental and rateable) are directly affected by environmental and amenity factors; and hence these factors should account for their variation.
6. High rental values are found in localities of high family income.
7. Rental values and rateable values are negatively related with occupancy rate, increase in distance from CBD and place of employment.
8. Rental values and land prices have positive relation with better 'services' and 'amenities' available in the neighbourhood, *i.e.*, nearness to shopping centre and transportation facilities.

4 ANALYTICAL METHODS AND RESULTS

In growing metropolitan cities of India, the urban land prices have been increasing since the beginning of planned development. But more recently, the increase has been so sharp, particularly in big metropolitan cities, such as Madras, Delhi, Bombay and Calcutta[1] that it has become very difficult for the fixed income group persons to maintain even the customary levels of living at the existing levels of income. Whatever the increase in dearness allowance and annual increments in the salary one gets, it all goes to rent, *i.e.*, about one-third or one-fourth of the salary. This could be seen from the fact that the increase in land values[2] has, on an average, been four-fold as against a two-fold increase in the cost of living index.[3] The increase in property value results in higher rents which have risen quite high more recently probably due to monopolistic withholding of land in the hands of a few rich persons or institutions, who can afford to withdraw land from the market so long as they do not get high land prices, most often resulting into skewed distribution of income in urban areas. However, apart from the overall increase in rents and property values, there exists a wide variation in rents from one locality to another, probably due to differences in the price structure, the levels of income, diversification of land-use, density pattern,

[1]In Madras, the minimum price per square yard of land increased from Rs. 80 in 1961-64 to Rs. 410 in 1969 and the maximum price from Rs. 215 to Rs. 742. For the corresponding period in Ahmedabad, the minimum price per square yard increased from Rs. 46 to Rs. 151 and the maximum price from Rs. 210 to Rs. 400. Likewise in Delhi also the minimum price per square yard increased from Rs. 23 in 1961-64 to Rs. 44 in 1969 and the maximum price for the corresponding period from Rs. 50 to Rs. 126-*cf.* Report of the Urban Land Inventory prepared by the Centre for Urban Studies (Erstwhile CMA at the Indian Institute of Public Administration) for National Building Organisation, 1971 (Typed script).

[2]At times in the undeveloped areas, within municipal limits, the increase has, in some cases, been to the extent of 4,900 per cent-*cf. Yojana*, January 1966, p. 56.

[3]Government of India, Town & Country Planning Organisation, *Land Values in Delhi*. A Report prepared for submission to the Ministry of Home Affairs, 1970 (Mimeo.).

levels of population growth, structural designs, etc. The economic factors such as 'accessibility-space-transportation costs' and access to some of the most essential 'services' such as water supply, sewerage lines, electricity, etc., along with certain 'amenity' factors like nearness to shopping centre, availability of health, educational and recreational facilities also contribute to rents and property value differentials.

STUDY AREA, DESIGN AND DATA BASE

Keeping the above considerations in view, the study attempts to examine how the environmental factors are affecting the land and property values in 13 different localities of urban Delhi on the basis of data collected for 446 households for the period 1977-78 in Delhi.[4] A general social and economic profile of each locality is given in Appendix II. Specifically, in the light of the objectives mentioned earlier, the study is directed : (*i*) to explain the differentials and gaps between rental values, land values and property values, (*ii*) how and in relation to what environmental and 'amenity' factors did these values vary, and (*iii*) how these variations are useful in providing a positive basis for normative decisions.

The data for the study in respect of rateable and rental value of property for 446 households was collected on the basis of total rent being paid or assessed for the entire property. This was obtained from the municipal records for the period 1977-78. Part of the data was also collected on the basis of the structured questionnaire designed for the household survey (Appendix III). Based on these, an average rent of the property was calculated for each locality under study. In the case of owner and tenant living in the same house or property, the rent for the entire property was estimated for the reference period 1977-78 on the basis of actual rent being paid by the

[4] The area of study is confined to 13 out of 15 localities as contained in the study 'Distribution and Differential Location of Public Utilities in Urban Delhi. The two localities dropped from the study are Khichripur-Kalyanpuri and Uttam Nagar-J.J. Colony, developed during the emergency period 1975-77 as relocation colonies. The size of universe consists of 446 households in 13 selected colonies of urban Delhi. See Misra, Girish K. & K.S.R.N. Sarma, *Distribution and Differential Location of Public Utilities in Urban Delhi, op.cit.*, pp. 7-8.

tenant for the portion occupied by him and a corresponding estimate was made for the owner-occupied portion. In respect of notional land value per square metre, the information supplied by the household was supplemented by an inventory of land market intelligence and property dealers of the respective localities. The problem of estimating the notional land value proved to be more difficult in older areas where there was no vacant land available for sale. The estimates in regard to such localities are based completely on respondent's own assessment and the market intelligence of the interviewer keeping in view the environmental conditions of the locality. Of course, the assumptions of homogeneity in rental value for the owner occupied accommodation is the same as that of the tenant. This is a problem posing question which needs verification through sensitivity analysis.

POSTULATES AND VARIABLES

The property value is a function of the structural attributes of environment, the land value of the plot, and the rental value of property. There is a positive relationship between rental value and land value. Rental value increases with an increase in land value per square metre. But land value increases proportionately more than rateable value of property. High rental values are found in the localities of high income groups and in better quality environs. In view of this, it is postulated that rental and rateable property values have negative relations with increase in occupancy rate, increase in distance from residence to central business district (CBD) and to place of employment but have positive relation with better amenities available in the neighbourhood, *i.e.*, nearness to shopping centre, transportation facilities, etc.

SPECIFICATION OF VARIABLES

The multiplicity of 'environmental' and 'amenity' factors are instrumental in affecting the aggregate property value. To select the most important variables, a correlation matrix of zero order significance for all the 39 variables as listed in Appendix IV was constructed in the first stage of analysis. But in urban areas the residential choice is determined not by

accessibility alone but rather by the environmental structure and its attributes in terms of amenities and services of the area in which the house is located.

After having selected most important variables as listed in Appendix V, the favourable attributes of environmental structure in terms of occupancy rate, family income, distance from residence to place of work, to central business district, to shopping centre and the availability of transport facilities as surrogate to urban environmental structure were selected in the second stage of the analysis. These factors affect rental and property values directly and indirectly and work together and have their combined and complementary effects because these are correlated among themselves. These important variables that deal with the economic, social and physical aspect of human environment contribute significantly in the variation of rental values, land values and rateable values. These are specified and given on page 33 with their form of measure and data base.

FUNCTIONAL FORM

In order to study the differentials in rental values, land values and property values and their reciprocals, the following two types of functions have been fitted :

(1) $Y = a + b_1 x_1 \ldots\ldots b_n x_n$

(2) $Y = a x_1^{b_1} \ldots\ldots x_n^{b_n}$

The factors which have been mentioned above are, sometimes, highly correlated. This creates problems in interpreting the results of individual coefficients due to multicollinearity of variables. Hence the zero order correlation among variables given in Table 1 reveals that rateable value (x_1) and rental value (x_2) are highly correlated. Therefore, both the variables have not been taken simultaneously for the regression analysis. There is some correlation between occupancy rate (x_5) and rateable value (x_1) and rental value (x_2) ; otherwise there does not appear to be high correlation among the variables. And therefore, it would not create any multicollinearity problem in the regression analysis.

Variables, Form of Measure and Data Base

Variable (s)	*Form of Measure*	*Data Base*
Rateable values	Mean annual value in Rs.	Field Survey & MCD *
Rental Value	Estimated mean annual value in Rs.	Field Survey & MCD
Land value	Notional market value (per sq. metre in Rs.)	Respondents and Property Dealers.
Family Income	Monthly in Rs.	Public Utilities Survey †
Occupancy Rate	Persons living per room	Field Survey
Distance from residence to place of work	Mean access distance in kms.	Public Utilities Survey‡
Availability of buses for different nodal points	Total number in an hour	Public Utilities Survey‡
Distance from Residence to CBD ‡	Mean access distance in kms.	Field Survey
Shopping Centre	Mean access distance from residence in kms.	Field Survey

* MCD = Municipal Corporation of Delhi.

† Misra, Girish K. and K. S.R.N. Sarma, *Distribution and Differential Location of Public Utilities in Urban Delhi*, Indian Institute of Public Administration, 1979.

‡ Connaught Place is the CBD although urban Delhi has a few more nodes or sub-central business districts.

NOTE : The environmental factors classified on the basis of discussion in the test are 1 to 4 as socio-economic, 5 as physical, 6-7 as utilities and services, and 8-9 as urban amenities.

Of the two types of functions fitted, the first is the linear function and the second is curvilinear popularly known as Cobb-Douglas function. The advantage of the latter over the former is that the regression co-efficients of this model can be interpreted directly as the elasticities of each independent variable with respect to dependent variable. Secondly, this functional form also provides curvilinear shape to the curve. In the real situation, at least, the linear relationship is not expected to hold as there happens to be a limit beyond which any increase in rentals and urban land values is not expected to cross. Thirdly, it also eliminates the effect of differential size of variables used in the model.

TABLE 1 CORRELATION MATRIX

Variables	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
x_1	1.000	0.9958	0.3218	0.3106	−0.6420	−0.0426	−0.2772	−0.1918	0.4094
x_2		1.0000	0.3391	0.3506	−0.6627	−0.0099	−0.2671	−0.2147	0.4394
x_3		...	1.0000	0.2153	−0.1247	−0.3437	−0.3838	−0.7047	0.1736
x_4		...	...	1.0000	−0.5480	−0.2495	−0.2864	−0.0557	0.7795
x_5		...	...	...	1.0000	−0.4453	−0.1416	−0.2038	−0.3582
x_6		...	...	...	...	1.0000	−0.0307	0.5824	0.3160
x_7		...	...	...	...	...	1.0000	−0.4251	−0.0770
x_8		...	...	...	...	...	...	−1.0000	−0.1447
x_9		...	...	...	...	...	...	...	1.0000

NOTE : x_1 = Rateable value, x_2 = Rental value, x_3 = Land value, x_4 = Family income, x_5 = Occupancy rate, x_6 = Distance from residence to place of work, x_7 = Availability of buses for going out of the locality in different directions, x_8 = Distance from residence to CBD, x_9=Distance of nearest shopping centre from residence.

The number of functional models and their definitions below which measure the variation in rateable values, rental values and land values and their reciprocals and also the contribution of 'environmental' and 'amenity' factors on land and property values are given. The summary statistics used in the models could be seen vide Appendix VI.

Regression Models

Linear Function	*Model*
$Y_1 = a + b_1y_2 + b_2y_3$	1
$Y_1 = a + by_2$	2
$Y_2 = a + by_1$	3
$Y_2 = a + by_3$	4
$Y_3 = a + by_2$	5
Cobb-Douglas Function	
$Y_1 = ay_2^{b1}\, y_3^{b2}$	6
$Y_1 = a\ y_1^{b1}$	7
$Y_2 = a\ y_1^{b1}$	8
$Y_2 = a\ y_3^{b3}$	9
$Y_3 = a\ y_2^{b2}$	10

Where,

Y_1 = annual rateable value
Y_2 = annual rental value
Y_3 = land value per square metre
a = constant

Linear Function	*Model*
$Y_1 = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6$	11
$Y_1 = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$	12
$Y_2 = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6$	13
$Y_2 = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$	14
$Y_3 = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6$	15
$Y_3 = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$	16

Where,

Y_1 = annual rateable value of the property
Y_2 = annual rental value of the property
Y_3 = land value per square metre
a = constant
x_1 = family income
x_2 = occupancy rate
x_3 = distance from residence to place of work
x_4 = availability of buses in the locality for different directions
x_5 = distance from the residence to CBD
x_6 = distance of nearest shopping centre from residence
x_7 = annual rental value with respect to Y_3 and annual land value with respect to Y_2; both have been used as independent variables in the models.

Cobb-Douglas Model

Functions	*Model*
$Y_1 = ax_1^{b1}\ x_2^{b2}\ x_3^{b3}\ x_4^{b4}\ x_5^{b5}\ x_6^{b6}$	17
$Y_1 = ax_1^{b1}\ x_2^{b2}\ x_3^{b3}\ x_4^{b4}\ x_5^{b5}\ x_6^{b6}\ x_7^{b7}$	18
$Y_2 = ax_1^{b1}\ x_2^{b2}\ x_3^{b3}\ x_4^{b4}\ x_5^{b5}\ x_6^{b6}$	19
$Y_2 = ax_1^{b1}\ x_2^{b2}\ x_3^{b3}\ x_4^{b4}\ x_5^{b5}\ x_6^{b6}\ x_7^{b7}$	20
$Y_3 = ax_1^{b1}\ x_2^{b2}\ x_3^{b3}\ x_4^{b4}\ x_5^{b5}\ x_6^{b6}$	21
$Y_3 = ax_1^{b1}\ x_2^{b2}\ x_3^{b3}\ x_4^{b4}\ x_5^{b5}\ x_6^{b6}\ x_7^{b7}$	22

Where,

Y_1 = annual rateable value of the property
Y_2 = annual rental value of the property
Y_3 = land value per square metre
a = constant
x_1 = family income
x_2 = occupancy rate
x_3 = distance from residence to place of work
x_4 = availability of buses in the locality for different directions
x_5 = distance from residence to CBD
x_6 = distance of nearest shopping centre from residence
x_7 = annual rental value with respect to Y_3 and annual land value with respect to Y_2; both have been used as independent variables in the model.

RESULTS AND EMPIRICAL FINDINGS

Relation Between Rateable Value and Rental Value

The first set of regression result involves the test of the hypothesis that assessed rateable property values are directly affected by increase in rental values and land values. The relationship between rateable value and rental value was found significant at 1 per cent level but land value has no direct relation with rateable value in model 1 of Table 2. Rental value explains 99.03 per cent variation in rateable value since by excluding land value (per square metre in rupees) there is no appreciable decrease in the explanatory power of the model 2, the adjusted coefficient of determination $\bar{R}^2$ rather improves and becomes 99.09 per cent.

The regression coefficient in model 2 indicates that an increase in rental value of Re. 1.00 will increase the rateable value by 0.68 paise only; whereas the reciprocal of this model in model 3 indicates that if (by chance) rateable value is increased by Re. 1.00, the rental value will be increased by Rs. 1.45.

TABLE 2 REGRESSION COEFFICIENTS AND STANDARD ERRORS OF RATEABLE PROPERTY VALUE, RENTAL VALUE AND LAND VALUE UNDER LINEAR FUNCTION

Model	*Constant*	*Regression Coefficient*		$\bar{R}^2$	R^2
		b_1	b_2		
1	201.85	0.6882***	−0.5021	.9903	.9919
		(0.0208)	(0.8484)		
2	−8.76	0.6840***		.9909	.9916
		(0.0189)			
3	72.60	1.4497***		.9903	.9916
		(0.0402)			
4	521.92	13.8556***		.0850	.1150
		(11.5908)			
5	419.46	0.0083**		.0850	.1150
		(0.0069)			

NOTE : Figures in parenthesis are standard errors of regression coefficients. Figures without asteriks are not significant.

*** Significant at 1 per cent level of probability.

** Significant at 5 per cent level of probability.

As compared to absolute changes, proportionate[5] changes measured in terms of elasticity as given in Table 3 indicate that the elasticity of rateable value with respect to rental value, is 110.72 per cent and the elasticity of rental value with respect to rateable value 78.48 per cent. It implies that rateable value is more elastic (more than unity) to changes in rental value than rental value (less than unity) to changes in rateable value. Both the coefficients in models 7 and 8 are significant at 1 per cent level of probability.

The above findings indicate that the propensity to change in absolute rental value happens to be more than the relative one indicating thereby that the rateable value increases at a very low rate while the rental value increases at a much higher

TABLE 3 REGRESSION COEFFICIENTS AND STANDARD ERRORS OF RATEABLE PROPERTY VALUE, RENTAL VALUE AND LAND VALUE UNDER COBB-DOUGLAS FUNCTION

Model	*Constant*	*Regression Coefficient*		$\bar{R}^2$	R^2
		b_1	b_2		
6	−1.3844	1.1088*** (0.1399)	0.0036 (0.3183)	.8427	.8689
7	−1.3659	1.1072*** (0.1297)		.8570	.8689
8	2.1567	0.7848*** (0.0919)		.8570	.8689
9	5.0347	0 5339 (0.6069)		.0308	.0551
10	5.2149	0.1031 (0.1288)		.0308	.0551

NOTE : Figures in parenthesis are standard errors of regression coefficients. Figures without asteriks are not significant.

*** Significant at 1 per cent level of probability.

[5]The partial derivative of rateable value with respect to rental value, that is $\triangle Y_1/\triangle Y_2 = 0.6840$ in model 2 is less than the partial derivative of $\triangle Y_1/\triangle Y_2 = 1.4497$ in model 3 whereas, the relative change in $\triangle Y_1/Y_1 \div \triangle Y_2/Y_2 = 1.1072$ in model 7 is greater than $\triangle Y_2/Y_2 \div \triangle Y_1/Y_1 = 0.7848$ in model 8 where, Y_1 is annual rateable value of property and Y_2 is annual rental value of property.

rate. This catches the real situation of urban land and capital market in Delhi, where the strong lobbying of landlords is having full grip over the situation and the government machinery is proving ineffective in terms of partial rent control measures or in enhancing the property values. In the absence of other more flexible measures, recourse to property taxation distorts the urban land market.

RELATION BETWEEN RENTAL VALUE AND LAND VALUE

The results of regression of rental value on land value involves the test of the hypothesis that rents are directly affected by increases in land values per square metre. When rental value changes by Re. 1.00, the land value changes by Rs. 13.85 (model 14) and its reciprocal *i.e.*, if land value changes by Re. 1.00, the rental value changes by less than a paise, *i.e.*, 0.0083 (see model 15). Both the relations are significant at 1 and 5 per cent level of probability and only about 12 per cent variation in rental value is explained by changes in land values (Table 3). The elasticity of land value with respect to rental value is 53 per cent (model 9), whereas, its reciprocal only 10 per cent (model 10). This amounts to saying that the impact of rental values hike in urban land market is tremendous and cannot be explained in terms of rents alone or its control measures.

In view of the tremendous increase in urban land values to the extent of Rs. 13.85 for one rupee increase in rental value, the market is so tight and speculative that it accounts for a sizable proportion of urban land market dealings through underhand transaction. Since rentals are less elastic to changes in rateable values, every bit of increase in property value proportionately leads to a more sympathetic rise in rentals through underhand transactions.

Rentals should generally reflect land and property values alike. But at times, it has been noticed that most of the properties valued at several lakhs of rupees are having rateable property value assessed for a few hundreds or thousands of rupees. There is no evidence of market value incrémentals either in 'rentals' of such properties or in their 'rateable values'. In such cases, the benefits of incrementals in property values remain concealed and transacted through 'pugree'—a sort of

underhand transaction, putting the public exchequer to a loss. There is no reason to believe that if the urban land values are rising, this rise should not be reflected in the rental and property values.

The most interesting part of the gaps and distortions in urban land market is that the land value hikes are not reflected in rental values. The model has completely broken down not only in explaining the rental value but even when it has been tested along with other variables, it has failed to account for the variation in rental values. It is the distance function from CBD, family income and rental which are catching up the land value. This again confirms that urban land market is highly imperfect. With the result, the real social, economic and institutional forces that are operating in urban land market have created a duopolistic market which has become a lucrative source of business for rich people to borrow to purchase land and to borrow against the increase in the value of land.[6] Thus it creates a cycle of continuous benefits of capital gains through incrementals in land values which remain unaccounted for by the rental values.

CONTRIBUTION OF ENVIRONMENTAL AND AMENITY FACTORS

So far an attempt has been made to explain the differentials in rateable property values, rental values, and land values. But now an attempt is being made to know : (1) how and in relation to what 'environmental' and 'amenity' factors did these values—actual land value, rental value and rateable property value—vary; and (2) how this variation is useful for policy implications. To measure these relations, the multiple regression analysis has been attempted both in linear and curvilinear form. The summary results of each model are given in Table 4 and their details in Tables 5-16.

Rateable Values

The regression of rateable values (y_1) on independent variables, *viz.*, family income (x_1), occupancy rate (x_2), distance from

[6]Lowe, John W., "Land Speculation : Does It Have Real Economic Consequences ?" *Finance and Development*, Vol. XII (B), 1975, p. 32.

residence to place of work (x_3), availability of buses (x_4), distance from residence to CBD (x_5), and distance from residence to shopping centre (x_6), shows that all the coefficients are significant at 1 per cent level of probability excepting the coefficient b_3 and together they explain 91.51 per cent variation in rateable property values in model 11. The coefficient 'b_3' (distance to work place), however, becomes significant at 5 per cent level of probability and gives an expected sign under curvilinear (model 17). It tells that for an increase in occupancy rate by one person, the rateable value will decrease by Rs. 2.31 and explains 30 per cent variation in rateable property value.

In the analysis, the regression coefficients of different enviromental factors with respect to rateable value indicate that there is a significant negative relation between distance from residence to CBD and of occupancy rate with the rateable value and both account for about 65 per cent variation in the total contribution of the explanatory variables. But family income gives an unexpected significant negative sign. The inverse relation between family income and property value is perhaps due to non-reliability of income data. With the result, the observed relationship between environmental quality of the locality and property value subsumes both 'family income' as well as 'income effect' of quality change. This is in consonance with the general conclusion drawn by Nourse[7] in his analysis of the effect of air pollution on house values.

Availability of buses gives an expected sign but not significant under curvilinear model. It tells us that if a single unit of bus service is added in the service of the locality, the property value gets enhanced by 89 paise. This is perhaps due to the inclusion of single measure of accessibility in the study which seems to have given possibly a weak relation due to multiple accessibility measure such as the use of private vehicles (scooters, cars, trains, cycles, etc.) and less dependence on public transport chosen as an independent variable for the study. Or there is a possibility of a relatively better public transportation facilities organised in the localities having low property values.

Distance plays a very important role in studies of relative property values concerning many theories of residential

[7]Nourse, H.G., "The Effect of Air Pollution on Property Values," *Land Economics*, Vol. 13, 1967, pp. 181-189.

TABLE 4 REGRESSION COEFFICIENTS INDICATING CONTRI- THEIR STANDARD ERRORS AND INCREMENTAL VALUE AND

Linear Function

Model No.	*Standard Errors and Incremental Contribution*	*Constant 'a'*	*Regression* b_1	b_2
11	Rateable Value of property	4382.81	−5.53***	−8949.17***
	Standard Errors		(1.34)	(1380.40)
	Incremental Contribution (%)		24.09	59.45
12	Rateable Value of Property	39390.81	−5.86***	−8476·19***
	Standard Errors		(1.31)	(1376.31)
	Incremental Contribution (%)		25.92	49.22
13	Rental Value	62889.29	−7.55***	−2791.36***
	Standard Errors		(1.89)	(1945.68)
	Incremental Contribution (%)		21.19	5.53
14	Rental Value	56856.86	−7.99***	−12148.84***
	Standard Errors		(1.87)	(1961.01)
	Incremental Contribution (%)		22.79	47.74
15	Land Value	781.31	0.05	−74.81
	Standard Errors		(0.10)	(105.89)
	Incremental Contribution (%)		1.66	3.27
16	Land Value	−899.53	0.24	250.59
	Standard Errors		(0.19)	(293 70)
	Incremental Contribution (%)		22.66	10.08
	Cobb-Douglas Function			
17	Rateable Value of Property	11.72	−0.10	−2.31***
	Standard Errors		(0.58)	(0.66)
	Incremental Contribution (%)		00 09	30.19
18	Rateable Value of Property	14.59	0 41*	−2.45***
	Standard Errors		(0.52)	(0.50)
	Incremental Contribution (%)		1.07	33.44
19	Rental Value	12.34	−0 03	−1.52**
	Standard Errors		(0 42)	(0.53)
	Incremental Contribution (%)		00.01	18.56
20	Rental Value	14.41	0.34	−1.62***
	Standard Errors		(0.45)	(0.48)
	Incremental Contribution (%)		1.06	20.77
21	Land Value	2.57	0.46*	−12.98
	Standard Errors		(0.30)	38.16
	Incremental Contribution (%)		13.55	00.69
22	Land Value	7.62	0.45*	−0.75
	Standard Errors		(0.27)	(0.52)
	Incremental Contribution (%)		12.90	9.98

***Significant at 1 per cent level of probability.
**Significant at 5 per cent level of probability.
*Significant at 10 per cent level of probability.

BUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR, CONTRIBUTIONS TO RATEABLE PROPERTY VALUE, RENTAL LAND VALUE

Coefficients					*Coefficients of Determination (per centage)*	
b_3	b_4	b_5	b_6	b_7	*Total* R^2	*Adjusted* $\bar{R}^2$
−654.85	−396.86***	−464.17**	14163.80***	6.32	91.51	83.03
(425.56)	(276.61)	(243.43)	(3814.98)			
3.35	15.79	5.15	19.50	(5.09)	93.51	84.43
−601.40*	−982.03***	300.11	14751.48***			
(409.96	(270.97)	(268.13)	(3685.27)	1.99		
2.78	17.05	1.62	20.78			
−681.24	1328.82***	811.08**	19337.24***		92.05	84.09
(599.83)	(385.65)	(345.15)	(5377.16)			
1.70	15.75	7.41	17.15			
608.65	−1444.53***	−588.22	20135.68***	8.59	93.78	85.08
(584.12)	(386.08)	(382.05)	(5250.87)	(7.26)		
1.34	17.41	2.95	18.24	1.74		
−8.45	13.47	−25.94	−92.95		60.67	21.33
(32.64)	(20.98)	18.67)	(292.64)			
00.43	2.70	12.65	00.67			
8.87	47.27	−5.31	584.87	0.025	69.26	26.22
(34.84)	(35.07)	(25.13)	(503.41)	(0.021)		
00.89	25.13	00.61	18.67	19.36		
−1 49***	0.89	−0.08	0.78**		84.91	69.81
(0.59)	(0.79)	(0.33)	(0.36)			
15.89	3.15	00.15	11.56			
−1.30*	1.12*	−0.53	0.56*	1.11*	91.08	78.58
(0 51)	(0.67)	(0.67)	(0.36)	(0.59)		
11.5	4.81	3.65	5.10	6.16		
−0.43	−0.21	−0.34	0.61**		86.25	72.47
(0.47)	(0.63)	(0.26)	(0.29)			
2.37	00.25	3.80	68.85			
0.35	0 04*	0.66*	0.45	0.80*	90.76	77.82
(0.43)	(0.58)	(0.31)	(0.28)	(0 51)		
1.16	00.01	8.21	4.60	0.05		
0.17	0.20	−0.40*	−0.20		63.74	27.49
(0.34)	(0.45)	(0.19)	(0.20)			
1.54	1.21	26.75	5.58			
−0.03	0 12	−0.54*	0.05	−0.41*	75.66	41.58
(0.33)	(0 41)	(0.19)	(0.24)	(0.26)		
00.02	00.41	38.24	00.18	11.90		

TABLE 5 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR IN EXPLAINING VARIATION IN RATEABLE VALUE (LINEAR FUNCTION)

MODEL 11

Variables: *Dependent* : *Rateable Value* *Independent* : X_1, X_2, X_3, X_4, X_5 *and* X_6	*Regression Coefficient*	*Standard Error of Reg. Coeff.*	*Incremental Contribution*	*Significance of* $\triangle R^2$
'a' Constant = 43824. 810	'b'	Se	Marginal	'F' Ratio
X_1 Family income	−5 5320***	1.3405	0.2409	17.0239
X_2 Occupancy rate	−8949.1725***	1380.4089	0.5945	42.0163
X_3 Distance : place of work	−654.8486	425.5682	0.0335	2.3654
X_4 Availability of Buses	−396.8642***	273.6125	0.1519	10.7387
X_5 Distance : CBD	−464.1656**	243.4571	0.0515	3.6328
X_6 Distance : shopping centre	14163.8030***	3814.9489	0.1950	13.7789

Total incremental contribution of all the variables	=	1.2673
Total contribution of explanatory variables R^2	=	0.9151
Multicollinearity effect $R^2-\Sigma(R^2-R_h^2)$	=	−0.3522
Adjustment effect $R^2 - \bar{R}^2$	=	0.0848
Proportional contribution of explanatory variables $\bar{R}^2$	=	0.8303
Test of significance of coefficient of determination 'F'	=	10.7860***
Degrees of Freedom	=	(6,6)

*** Significant at 1 per cent level of probability.

** Significant at 5 per cent level of probability.

TABLE 6 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR IN EXPLAINING VARIATION IN RATEABLE VALUE (COBB-DOUGLAS FUNCTION)

MODEL 17

Variables: *Dependent*: *Rateable Value* *Independent*: X_1, X_2, X_3, X_4, X_5 *and* X_6	*Regression Coefficient*	*Standard Error of Reg. Coeff.*	*Incremental Contribution*	*Significance of* $\triangle R^2$
'a' Constant=11.7271	'b'	Se	Marginal	'F' Ratio
X_1 Family income	−0.1028	0.5346	0.0009	0.0369
X_2 Occupancy rate	−2.3065***	0.6659	0.3019	12.0062
X_3 Distance: place of work	−1.4928**	0.5936	0.1589	6.3202
X_4 Availability of Buses	0.8882	0.7930	0.0515	1.2544
X_5 Distance: CBD	−0.0802	0.3314	0.0015	0.0586
X_6 Distance: shopping centre	0.7859**	0.3656	0.1156	4.5967

Total incremental contribution of all the variables	$= 0.6103$
Total contribution of explanatory variables	$R^2 = 0.8491$
Multicollinearity effect	$R^2 - \Sigma(R^2 - R^2_h) = 0.2388$
Adjustment effect	$R^2 - \bar{R}^2 = 0.1510$
Proportional contribution of explanatory variables	$\bar{R}^2 = 0.6981$
Test of significance of coefficient of determination 'F'	$= 5.6250^{**}$
Degrees of Freedom	$= (6,6)$

*** Significant at 1 per cent level of probability.
** Significant at 5 per cent level of probability.

TABLE 7 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR INCLUDING LAND VALUE IN EXPLAINING RATEABLE VALUE (LINEAR FUNCTION)

MODEL 12

Variables : *Dependent* : *Rateable Value* *Independent* : X_1, X_2, X_3, X_4, X_5, X_6 *and* X_7	*Regression Coefficient*	*Standard Error of Reg. Coeff.*	*Incremental Contribution*	*Significance of* $\triangle R^2$
'a' Constant=39390.814	'b'	Se	Marginal	'F' Ratio
X_1 Family income	−5.8594***	1.3110	0.2592	19.9720
X_2 Occupancy rate	−8476.1973***	1376.3186	0.4922	37.9210
X_3 Distance : place of work	−601.4047*	409.9605	0.0278	2.1492
X_4 Availability of Buses	−982.0376***	270.9667	0.1705	13.1334
X_5 Distance : CBD	−300.1134	268.1358	0.0162	1.2522
X_6 Distance : shopping centre	14751.4810***	3685.2707	0.2078	16.0160
X_7 Land Value	6.3224	5.0984	0.0199	1.5376

Total incremental contribution of all the variables	= 1.1930
Total contribution of explanatory variables	R^2 = 0.9351
Multicollinearity effect	$R^2-\Sigma(R^2-R^2_i)$ = −0.2585
Adjustment effect	$R^2-\bar{R}^2$ = 0.0908
Proportional contribution of explanatory variables	$\bar{R}^2$ = 0.8443
Test of significance of coefficient of determination 'F'	= 7.2880***
Degrees of Freedom	= (7,5)

*** Significant at 1 per cent level of probability.
* Significant at 10 per cent level of probability.

TABLE 8 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR INCLUDING LAND VALUE IN EXPLAINING VARIATION IN RATEABLE VALUE (COBB-DOUGLAS FUNCTION)

MODEL 18

Variables: *Dependent : Rateable Value* *Independent* X_1, X_2, X_3, X_4, X_5, X_6, and X_7	*Regression Coefficient*	*Standard Error of Reg. Coeff.*	*Incremental Con. tribution*	*Significance of* ΔR^2
'a' Constant = 14.5962	'b'	Se	Marginal	'F' Ratio
X_1 Family income	0.4091*	0.5279	0.0107	0.5991
X_2 Occupancy rate	—2.4521***	0.5662	0.3344	18.7439
X_3 Distance : place of work	—1.3009*	0.5105	0.1159	6.4923
X_4 Availability of Buses	1.1156*	0.6791	0.0481	2.6962
X_5 Distance : CBD	—0.5260	0.3680	0.0365	2.0420
X_6 Distance : shopping centre	0.5595*	0.3308	0.0510	2.8595
X_7 Land Value	—1.1148*	0.5997	0.0616	3.4522

Total incremental contribution of all the variables	$= 0.6581$
Total contribution of explanatory variables	$R^2 = 0.9108$
Multicollinearity effect	$R^2 - \Sigma (R^2 - R^2_h) = 0.2527$
Adjustment effect	$R^2 - \bar{R}^2 = 0.1250$
Proportional contribution of explanatory variables	$\bar{R}^2 = 0.7858$
Test of significance of co-efficient of determination 'F'	$= 7.2880$***
Degrees of Freedom	$= (7,5)$

*** Significant at 1 per cent level of probability.
* Significant at 10 per cent level of probability.

TABLE 9 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR IN EXPLAINING VARIATION IN RENTAL VALUE (LINEAR FUNCTION)

MODEL 13

Variables : *Dependent : Rental Value* (Y_2) *Independent :* X_1, X_2, X_3, X_4, X_5, and X_6	*Regression Coefficient*	*Standard Error of Reg. Coeff.*	*Incremental Contribution*	*Significance of* $\triangle R^2$
'a' Constant=62889. 297	'b'	Se	Marginal	'F' Ratio
X_1 Family income	−7.5514***	1.8894	0.2119	15.9680
X_2 Occupancy rate	−12791.3600***	1945.6856	0.573	43.2175
X_3 Distance : place of work	−681.2433	599.8381	0.0170	1.2882
X_4 Availability of Buses	−1328.8240***	385.6566	0.1575	11.8680
R_5 Distance : CBD	−811.0803**	343.1527	0.0741	5.5838
X_6 Distance : shopping centre	19337.3400***	3377.1683	0.1715	12.9312

Total incremental contribution of all the variables	= 1.2053
Total contribution of explanatory variables	R^2 = 0.9205
Multicollinearity effect	$R^2-\Sigma (R^2-R^2_h)$ − 0.2848
Adjustment effect	$R^2-\bar{R}^2$ = 0.0796
Proportional contribution of explanatory variables	$\bar{R}^2$ = 0.8409
Test of significance of coefficient of determination 'F'	= 11.5730***
Degrees of Freedom	= (6,6)

*** Significant at 1 per cent level of probability.

** Significant at 5 per cent level of probability.

TABLE 10 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR IN EXPLAINING VARIATION IN RENTAL VALUE (COBB-DOUGLAS FUNCTION)

MODEL 19

Variables: *Dependent : Rental Value Independent* X_1, X_2, X_3, X_4, X_5 *and* X_6	*Regression Coefficient*	*Standard Error of Reg. Coeff.*	*Incremental Contribution*	*Significance of* $\triangle R^2$
'a' Constant=12.3442	'b'	se	Marginal	'F' Ratio
X_1 Family income	−0.0265	0.4299	0.0001	0.0056
X_2 Occupancy rate	−1.5228**	0.5354**	0.1856	0.0383
X_3 Distance : place of work	−0.4850	0.4773	0.0237	1.0323
X_4 Availability of Buses	−0.2079	0.6377	0.0025	0.1063
X_5 Distance : CBD	−0.3434	0.2665	0.0380	1.6589
X_6 Distance : shopping centre	−0.6091**	0.2940	0.1985	4.2890

Total incremental contribution of all the variables	= 0.3484
Total contribution of explanatory variables	R^2 = 0.8623
Multicollinearity effect	$R^2-\Sigma(R^2-R^2_h)$ = 0.5139
Adjustment effect	$R^2-\bar{R}^2$ = 0.1376
Proportional contribution of explanatory variables	$\bar{R}^2$ = 0.7247
Test of significance of coefficient of determination 'F'	= 6.2630**
Degrees of Freedom	= (6,6)

**Significant at 5

TABLE 11 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR INCLUDING LAND VALUE IN EXPLAINING VARIATION FOR RENTAL VALUE (LINEAR FUNCTION)

MODEL 14

Variables : Dependent : Rental Value Independent : X_1, X_2, X_3, X_4, X_5, X_6 and X_7	*Regression Coefficient*	*Standard Error of Reg. Coeff.*	*Incremental Contribution*	*Significance of $\triangle R^2$*
'a' Constant=56865.857	'b'	Se	Marginal	'F' Ratio
X_1 Family income	−7.9962***	1.8680	0.2279	18.3184
X_2 Occupancy rate	−12148.8390***	1961.0179	0.4774	38.3780
X_3 Distance : place of work	608.6502	584.1233	0.0134	1.0837
X_4 Availability of Buses	−1444.5294***	386.0811	0.1741	13.9951
X_5 Distance : CBD	−588.2205	382.0475	0.0295	2.3685
X_6 Distance : shopping centre	20135.6820***	5250.8786	0.1829	14.6996
X_7 Land Value	8.5888	7.2644	0.0174	1.3971

Total incremental contribution	= 1.1226
Total contribution of explanatory variables	R^2 = 0.9378
Multicollinearity effect	$R^2-\Sigma(R^2-R^2_h)$ = −0.1848
Adjustment effect	$R^2-\bar{R}^2$ = 0.0870
Proportional contribution of explanatory variables	$\bar{R}^2$ = 0.8508
Test of significance of coefficient of determination 'F'	= 10.7770***
Degrees of Freedom	= (7,5)

*** Significant at 1 per cent level of probability.

TABLE 12 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR IN EXPLAINING VARIATION IN RENTAL VALUE INCLUDING LAND VALUE (COBB-DOUGLAS FUNCTION)

MODEL 20

Variables : *Dependent : Rental Value* *Independent : X_1, X_2, X_3, X_4, X_5, X_6, and X_7*		*Regression coefficient*	*Standard Error of Reg. Coff.*	*Incremental Contribution*	*Significance of $\triangle R^2$*
'a'	Constant=14.4131	'b'	Se	Marginal	'F' Ratio
X_1	Family income	0.3426	0.4523	0.0106	0.5730
X_2	Occupancy rate	—1.6271***	0.4852	0.2077	11.2426
X_3	Distance : place of work	—0.3467	0.4374	0.0116	0.6273
X_4	Availability of Buses	—0.0439*	0.5818	0.0001	0.0056
X_5	Distance : CBD	—0.6648*	0.3153	0.0821	4 4437
X_6	Distance : shopping centre	0.4472	0.2834	0.0460	2.4869
X_7	Land Value	3—0.8039*	0.5138	0.0452	2.4461

Total incremental contribution of all the variables	= 0.4033
Total contribution of explanatory variables	$R^2 = 0.9076$
Multicollinearity effect	$R^2 - \Sigma (R^2 - R^2_h) = 0.5043$
Adjustment effect	$R^2 - \bar{R}^2 = 0.1294$
Proportional contribution of explanatory variables	$\bar{R}^2 = 0.7782$
Test of significance of co-efficient of determination 'F'	= 7.0140**
Degrees of Freedom	= (7,5)

***Significant at 1 per cent level of probability.
**Significant at 5 per cent level of probability.
*Significant at 10

TABLE 13 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR IN EXPLAINING VARIATION IN LAND VALUE (LINEAR FUNCTION)

MODEL 15

Variables : *Dependent : Land Value* *Independent : X_1, X_2, X_3, X_4, X_5, and X_6*	*Regression Coefficient*	*Standard Error of Reg. Coeffi.*	*Incremental Contribution*	*Significance of $\triangle R^2$*
'a' Constant 701.3134	'b'	Se	Marginal	'F' Ratio
X_1 Family income	0.0518	0.1028	0.0166	0.2530
X_2 Occupancy rate	−74.8094	105.8905	0.0327	0.4984
X_3 Distance : place of work	− 8.4527	32.6451	0.0043	0.0665
X_4 Availability of Buses	−13.4716	20.9887	0.0270	0.4108
X_5 Distance : CBD	−25.9476	18.6755	0.1265	1.9293
X_6 Distance : shopping centre	−92.9511	292.6428	0.0067	0.1005

Total incremental contribution of all the variables	= 0.2138
Total contribution of explanatory variables	R^2 = 0.6067
Multicollinearity effect	$R^2 - \Sigma (R^2 - R^2_h)$ = 0.3929
Adjustment effect	$R^2 - \bar{R}^2$ = 0.3934
Proportional contribution of explanatory variables	$\bar{R}^2$ = 0.2133
Test of significance of coefficient of determination 'F'	= 1.5420
Degrees of Freedom	= (6,6)

TABLE 14 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR IN EXPLAINING VARIATION IN LAND VALUE (COBB-DOUGLAS FUNCTION)

MODEL 21

Variables : Dependent : Land Value Independent : X_1, X_2, X_3, X_4, X_5 and X_6	*Regression Coefficient*	*Standard Error of Reg. Coeff.*	*Incremental Contribution*	*Significance of $\triangle R^2$*
a' Constant-2.5736	'b'	Se	Marginal	'F' Ratio
X_1 Family income	0.4592*	0.3066	0.1355	2.2410
X_2 Occupancy rate	−0.1298	0.3816	0.0069	0.1149
X_3 Distance : place of work	0.1721	0.3404	0.0154	0.2550
X_4 Availability of Buses	0.2040	0.4547	0.0121	0.2007
X_5 Distance : CBD	−0.3999*	0.1900	0.2675	4.4268
X_6 Distance : shopping centre	−0.2013	0.2097	0.0558	0.9216

Total incremental contribution of all the variables	$= 0.4932$
Total contribution of explanatory variables	$R^2 = 0.6374$
Multicollinearity effect	$R^2 - \Sigma(R^2 - R^2_h) = 0.1442$
Adjustment effect	$R^2 - \bar{R}^2 = 0.3625$
Proportional contribution of explanatory variables	$\bar{R}^2 = 0.2749$
Test of significance of coefficient of determination 'F'	$= 1.7580$
Degrees of Freedom	$= (6,6)$

* Significant at 10 per cent level of probability.

TABLE 15 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR INCLUDING RENTAL VALUE IN EXPLAINING VARIATION IN LAND VALUE (LINEAR FUNCTION)

MODEL 16

Variables:
Dependent : Land Value
Independent : X_1, X_2, X_3, X_4, X_5, X_6 and X_7

	Regression Coefficient	*Standard Error of Reg. Coeff.*	*Incremental Contribution*	*Significance of $\triangle R^2$*
'a' Constant=898.5359	'b'	Se	Marginal	'F' Ratio
X_1 Family income	0.2439	0.1906	0.2266	1.6358
X_2 Occupancy rate	250.5917	293.7048	0.1008	0.7276
X_3 Distance : place of work	8.8776	34.8465	0.0089	0.0645
X_4 Availability of Buses	47.2757	35.0798	0.2513	1.8144
X_5 Distance : CBD	−5.3144	25.1323	0.0061	0.0445
X_6 Distance : shopping centre	−584.8765	503.4135	0.1867	1.3479
X_7 Rental Value	0.0254	0.0215	0.1936	1.3971

Total incremental contribution of all the variables	= 0.9740
Total contribution of explanatory variables	R^2 = 06926
Multicollinearity effect	$R^2-\Sigma(R^2-R^2_h)$ = − 0.2814
Adjustment effect	$R^2-\bar{R}^2$ = 0.4304
Proportional contribution of explanatory variables	$\bar{R}^2$ = 0.2622
Test of significance of coefficient of determination 'F'	= 1.6090
Degrees of Freedom	= (7,5)

TABLE 16 CONTRIBUTION OF EACH ENVIRONMENTAL AND AMENITY FACTOR INCLUDING RENTAL VALUE IN EXPLAINING VARIATION IN LAND VALUE (COBB-DOUGLAS FUNCTION)

MODEL 22

Variables: *Dependent: Land Value* *Independent:* X_1, X_2, X_3, X_4, X_5, X_6 *and* X_7	*Regression Coefficient*	*Standard Error of Reg. Coeff.*	*Incremental Contribution*	*Significance of* $\triangle R^2$
'a' Constant=7.6205	'b'	Se	Marginal	'F' Ratio
X_1 Family income	0.4484*	0.2753	0.1290	2.504
X_2 Occupancy rate	−0.7524	0.5252	0.0998	2.0506
X_3 Distance : place of work	−0.0262	0.3307	0.0002	0.0062
X_4 Availability of Buses	0.1190	0.4118	0.0041	0.0829
X_5 Distance : CBD	−0.5403*	0.1927	0.3824	7.8568
X_6 Distance : shopping centre	0 0477	0.2465	0.0018	0.0372
X_7 Rental Value	−0.4089*	0.2613	0.1190	2.4461

Total incremental contribution of all the variables	= 0.7363
Total contribution of explanatory variables	R^2 = 0.7566
Multicollinearity effect	$R^2-\Sigma(R^2-R^{-2}_h)$ = 0.0203
Adjustment effect	$R^2-\bar{R}^2$ = 0.3408
Proportional contribution of explanatory variables	$\bar{R}^2$ = 0.4158
Test of significance of coefficient of determination 'F'	= 2.2200
Degrees of Freedom	= (7,5)

* Significant at 10 per cent level of probability.

location. If distance from residence to central business district increases by 1 kilometer, property value decreases by Rs. 464 and accounts for 5.15 per cent variation. Similarly, if distance from residence to shopping centre increases by 1 km., rateable value changes by 0.78 paise contributing 11.56 per cent variation in the property value under curvilinear model and 19.50 per cent under linear model. An interesting significant positive relationship between rateable value and distance of shopping centre from residence indicates the desirability of certain minimum distance between shopping centre and residential neighbourhood. Whether this is by way of natural selection or a deleberate action of the planners in the placement of activities, it is difficult to say. But this is an important lesson and guideline for planners in the placement of activities.

Both the models 11 and 17 are good, fit and significant at 1 per cent level of probability with a total contribution of explantory variables $\bar{R}^2$ of 91.51 per cent in the variation of rateable value (under linear model) and 84.81 per cent (under curvilinear model).

The introduction of land value per square metre as one of the independent variable (X_7) in the model 12 improves the explanatory power of the model (Table 7). R^2 becomes 93.51 per cent but its marginal contribution is less than two per cent and it is not even significant. Though the regression coefficient becomes significant at 10 per cent level of probability with negative sign under Cobb-Douglas model 18, it implies that if the land value per square metre increases by rupee one, the rateable value decreases by Rs. 1.11 with a marginal contribution of 6.16 per cent in rateable value (Table 8). This indicates the real market situation where land value has no impact on incrementals in rateable value of property which remains unreflected in the real world of urban land market. This is quite evident from the negative elasticity of land value with respect to rateable value which is more than 111 per cent.

The family income gives an expected significant sign in this model and indicates that for every unit increase (by rupee one) in family income, rental value increases by 40 paise with an elasticity of 40.91 per cent with respect to family income.

RENTAL VALUE AND ENVIRONMENTAL FACTORS

The impact of environmental factors on rental value is more sensitive and the contribution of each environmental factors (X_1 to X_6) is similar to that of rateable value but it slightly improves the explanatory power of the model 13 and 19. All the coefficients are significant at 1 per cent level of probability except b_5 which is significant only at 5 per cent level. The marginal contribution of distance from residence to CBD (b_5) has increased. It explains 7.41 per cent variation in rental value for a unit change in distance by 1 kilometer. Occupancy rate is more catchy about rental value and accounts for 57 per cent variation. An increase in occupancy rate not only minimises the per capita availability of civic services with more pent up demand but at the same time decreases the rental value of property. This adversely affects the market value of the quality of environment since with respect to rental value, both occupancy rate and distance to shopping centre are significantly elastic, *i.e.*, 152 per cent and about 61 per cent, respectively. Other variables are not showing significant elasticities indicating thereby that the other environmental factors are not contributing to rental value in the specified model (Table 10).

By introducing land value in rupees per square metre, the explanatory power R^2 of the model 14 further improves and accounts for 93.78 per cent variation in rental value with an adjusted coefficient of determination $\bar{R}^2$ of 85.08 per cent (Table 11). We may recall that when land value was regressed on rental value in model 5, it indicated that for one rupee incremental in land value, rental value increased by less than a paise. But in model 14 when rental value has been regressed along with other environmental factors, the regression coefficient of rental value with respects to land value gives an expected but non-significant sign. However, this coefficient also becomes significant at 10 per cent level of probability under curvilinear model 20. This indicates that for a rupee change in land value per square metre, rental value changes by 80 paise with a marginal contribution of 4.52 per cent in the variation of rental value (Table 12). Since it is not the market rental value but the actual rent being paid or estimated for the

property, it does not account for true market rent which carries with it every bit of a sympathetic rise in land value. And this is the reason why the sign has become negative.

LAND VALUE AND ENVIRONMENTAL FACTORS

The regression of land value on the aforesaid X_1 to X_6 environmental factors to measure their contribution in the total variation of land value under model 15 in Table 13 shows that none of the coefficients is significant but each coefficient is giving an expected sign. This indicates that these factors are much more relevant for the study of land values and comprehend all the factors both specified and unspecified. But under curvilinear model 21, the expected sign of the coefficients of family income and the centrality of the node (CBD) both become significant at 10 per cent level of probability (Table 17). For a rupee change in the family income, land value per square metre changes by 45 paise and if distance from the residence to CBD increased by one kilometer, the land value per square metre changes by 20 paise. Both these factors account for about 40 per cent variation in land values in the model. The results are in conformity with the existing theories and their empirical contents.

The regression of land value along with rental value as an additional factor (X_7) in the model 22 increases the importance of the centrality of the node (CBD) as one of the explanatory variable in explaining the variation of land value from a marginal contribution of 26.75 per cent to 38.24 per cent. For one kilometer increase in distance from CBD, the land value per square metre decreases by 54 paise with a marginal contribution of 38 per cent (Table 16). The coefficient is significant at 10 per cent level of probability and R^2 explains 75.66 per cent variation in land values. These results are consistent with my earlier findings of land values in Delhi (1972) where CBD accounted for 35 per cent variation in land value under linear model and 44 per cent under curvilinear model.[8]

[8] Wishwakarma, R.K., *Land Values in Delhi : An Analysis of Spatial Variations and Trends*, Dissertation submitted for the award of M. Phil. Degree in Regional Development, Centre for the Study of Regional Development, School of Social Sciences, JNU, 1972 (typed script), pp. 39-40.

ANALYSIS OF ELASTICITY

Elasticity estimates resulting from the Cobb-Douglas function as given in model 17 to 22 indicate that the occupancy rate and distance to shopping centre have significant elasticities with respect to both annual rateable value and rental value. With rateable value, the negative elasticity of occupancy rate varies from 230 per cent to 245 per cent and of distance to shopping centre from 60 to 78 per cent with positive signs.

The introduction of land value per square metre as one of the independent variable changes the elasticities of both rateable value and rental value very significantly. With rental value, negative elasticity of occupancy rate varies from 152 to 162 per cent and of distance to shopping centre from 70 to 56 per cent. By introducing land value per square metre as an explanatory variable in the model, the coefficient of elasticities for amenities like the availability of buses from the locality for different direction and distance to CBD also become marginally significant with elasticity coefficients at 4 and 66 per cent, respectively.

RESIDUALS

The deviations of the observed from the predicted (fitted) values resulting from the amount of Y that have not been explained by the specified regression models for each individual locality under study are presented in Tables 17 and 18. The predicted values of annual rentals, rateable values of property and land values per square metre, all measured in terms of rupees and their percentage deviation, shows the values that ought to have been there in accordance with its stipulated relationships with explanatory variables. The residuals thus tell us the nature and extent to which each locality with respect to rateable property value, rental value and land value per square metre deviates from the expected value. A positive or negative residual thus suggests that the locality is relatively over-estimated or under-estimated with respect to the observed values of the dependent variable. In other words whether the individual localities conform to the regression line in terms of their rateable value, rental value and land value or not.

Rental Value

In analysing the results of residuals, if one considers the deviation of 10 per cent as 'normal' phenomenon, the localities like Moti Nagar, Old Rajender Nagar, Kalkaji, Outram Lines in model 2 of Table 17 indicate negative signs of marginal deviations which estimate the residuals of rental value not accounted for the purposes of assessment of rateable value. Thus it represents an estimated gap between the observed value and regressed value. Likewise, there are also colonies like Basti Harfool Singh, Ganj Mir Khan, Janakpuri and Arya Pura which show positive signs of marginal deviation.

Rateable Value

Residuals of rateable value on rental value as given in model 3 of Table 17 indicate the amount of rateable value that has not been explained by rental value, and thus, it may be treated as the marginal deviation in the direction of over and under assessment of rateable value of property. In each case, localities like Moti Nagar, Old Rajendra Nagar and Kalkaji are marginally under assessed; whereas Basti Harfool Singh, Ganj Mir Khan, Old Rajendra Nagar, Arya Pura, Sadar Cantt., etc., are overassessed which indicate the impact of rental value of commercial properties on the rateable value of residential properties due to proximity with centre of trade and commerce or business complex.

Property Value

Residuals of rent and land value taken together as measures of property value in model 1 of Table 17 indicate the residuals on both positive and negative side which show the extent to which property value deviates from the average regression line with respect to rateable value.

Corresponding residuals estimated by fitting the Cobb-Douglas function are given under model 6, 7, 8 and 10 in Table 18

Residuals with Environmental Factors

Considering the observed and predicted values of rateable values, rental values and land values when regressed along with other environmental services and amenities, the residuals

TABLE 17 VALUES OF RESIDUALS FOR EACH LOCALITY

Sl. No.	*Name of the Locality*	*Residuals of Regression (Linear) of*			
		Y_1 *on* Y_2	Y_2 *an* Y_1	Y_3 *on* Y_2	Y_1 *on* Y_2 & Y_3
1.	Moti Nagar	−174.25	207.69	15.70	−166.37
		−(16.75)	(11.61)	(3.48)	−(15.99)
2.	Basti Harfool Singh	231.09	−374.32	460.13	462.13
		(12.13)	−(15.21)	(51.12)	(24.25)
3.	Janak Puri	705.55	−1006.43	−195.14	607.57
		(10.17)	−(11.03)	−(65.04)	(8.76)
4.	Baird Road	321.44	−308.19	114.66	379.02
		(1.77)	−(1.18)	(15.28)	(2.09)
5.	Ganj Mir Khan	215.75	−357.70	−34.30	198.53
		(15.08)	−(20.00)	(8.57)	(13.88)
6.	Old Rajendra Nagar	−745.83	1063.14	39.12	−726.19
		−(28.03)	(21.29)	(7.82)	−(27.30)
7.	Outram Lines	−604.59	825.94	−128.72	−669.23
		−(403.06)	(74.00)	−(42.90)	−(446.15)
8.	Arya Pura	37.07	−107.50	274.46	174.88
		(7.00)	−(14.68)	(39.20)	(33.05)
9.	Civil Lines	−650.68	969.98	19.71	−640.78
		−(10.14)	(9.37)	(3.75)	−(9.98)
10.	Kalkaji	−340.14	406.46	−2.42	−341.35
		−(14.36)	(11.74)	−(0.53)	−(14.41)
11.	Vasant Vihar	−242.27	505.53	−56.85	−270.82
		−(1.40)	−(1.97)	−(9.88)	−(1.56)
12.	East Rohtas Nagar	66.84	−135.60	−265.47	−66.46
		−(3.73)	−(5.35)	−(151.69)	−(3.71)
13.	Sadar Cantt. (Delhi-Cantt.)	1180.01	−1748.99	−240.87	1059.06
		(40.19)	(67.79)	−(120.43)	(36.07)
	Models	(2)	(3)	(5)	(1)

NOTE

1. Residuals indicate the differences between the observed and the expected value of the dependent variable.
2. Figures in parenthesis indicate percentage.
3. Figures without parenthesis indicate amount in rupees.

Y_1 = Average annual rateable value;
Y_2 = Average annual rental value; and
Y_3 = Average (notional) land value per square metre.

TABLE 18 VALUES OF RESIDUALS FOR EACH LOCALITY

Sl. No.	*Name of the Locality*	*Residuals of Regression (Cobb-Douglas) of*			
		Y_1 *on* Y_2	Y_2 *on* Y_1	Y_3 *on* Y_2	Y_1 *on* Y_2 & Y_3
1.	Moti Nagar	21.84	−227.35	51.72	21.40
		(2.09)	−(12.71)	(11.49)	(2.05)
2.	Basti Harfool Singh	455.43	−780.70	488.40	451.39
		(23.90)	−(31.73)	(54.26)	(23.69)
3.	Janak Puri	750.58	−186.57	−171.15	760.51
		(10.82)	−(2.04)	−(57.04)	(10.69)
4.	Baird Road	−1631.92	7043.14	225.07	−1657.00
		− (9.01)	(27.07)	(30.00)	−(9.15)
5.	Ganj Mir Khan	411.84)	−799.54	1.72	411.82
		(28.79)	−(44.71)	(0.43)	(28.79)
6.	Old Rajendra Nagar	−513.39	780.65	57.24	−514.76
		−(19.30)	(15.63)	(11.44)	−(19.35)
7.	Outram Lines	−454.18	675.04	−79.38	−453.68
		(302.78)	(60.48)	−(26.45)	−(302.45)
8.	Arya Pura	150.22	−453.65	336.77	149.34
		(28.39)	−(61.97)	(48.10)	(28.23)
9.	Civil Lines	−693.77	1939.60	47.70	696.18
		(10.81)	(18.75)	(9.08)	−(10.85)
10.	Kalkaji	−95.86	127.95	17.56	−96.21
		−(4.04)	(3.22)	(3.90)	−(4.06)
11.	Vasant Vihar	2130.37	7326.49	50.95	−2136.77
		(12.34)	(28.62)	(8.86)	−(12.38)
12.	East Rohtas Nagar	293.39	−554.15	−237.82	297.95
		(16.39)	−(21.88)	−(135.89)	(16.64)
13.	Sadar Cantt.	1407.94	−1970.59	−213.62	1411.89
	(Delhi-Cantt.)	(47.95)	−(76.37)	−106.81)	(48.08)
	Models	(2)	(3)	(5)	(1)

NOTE

1. Residuals indicate the differences between the observed and the expected value of the dependent variable.
2. Figures in parenthesis indicate percentages.
3. Figures without parenthesis indicate amount in rupees.

Y_1 = Average annual rateable value;
Y_2 = Average annual rental value; and
Y_3 = Average (notional) land value per square metre

of all the functions fitted are given in Tables 19, 20, 21 for linear function and Tables 22, 23 and 24 for curvilinear functions. The residuals under each model indicate the possible gaps (both positive and negative) in the observed and estimated rental value, rateable value and land value with respect to the specified environmental and amenity factors of each locality.

On the basis of the regression analysis, it is possible to have an idea of localities which are accountable more in terms of the objective factors on environmental quality which contribute significantly in the variation of rental values, rateable property values and land values, but the residual analysis tells us the reciprocal of it, *i.e.*, the amount of dependent variable that have not been explained by the factor (s) fitted in the specified regression models.

CONCLUSIONS

The results strongly support that the property value is determined by the environmental quality of specific locations loaded with 'services' and 'amenities', in general and considerations of 'accessibility-space-transportation' costs, in particular. The success of land value model helps confirm the theoretical account and the contribution of the factors under consideration more than rental and rateable property value models. The implications of the alternative models suggest that it is the land value which gives much expected hypothesised relations with significant signs. The residential choice in terms of environmental quality including housing characteristics is a much more complex problem which calls for a behaviourist theory and socio-economic data on household income and expenditure pattern at micro-level. Some of the conclusions drawn are summarised below :

1. The propensity to change in rental value is more than rateable value although both change significantly with respect to each other. Since rentals are less elastic to changes in rateable values, every bit of increase in property value proportionately leads to a more sympathetic rise in rental value. If mopped up, it might become an additional source for further augmentation of municipal finances.

TABLE 19 VALUES OF RESIDUALS FOR EACH LOCALITY: RATEABLE VALUE WITH RESPECT TO ENVIRONMENTAL FACTORS

Sl. No.	*Name of the Locality*	*Residuals of*	
		X_1, X_2, X_3, X_4, X_5 & X_6 *on* Y_1	$X_1, X_2, X_3, X_4, X_5, X_6, X_7$ *on* Y_1
1.	Moti Nagar	−2217.19	−2434.98
		−(213.19)	−(234.13)
2.	Basti Harfool Singh	3282.74	1944.23
		(172.32)	(102.05)
3.	Janak Puri	1612.61	1094.23
		(23.25)	(15.77)
4.	Baird Road	2146.63	1679.85
		(11.85)	(9.27)
5.	Ganj Mir Khan	−2352.91	−1270.06
		−(178.52)	−(88.81)
6.	Old Rajendra Nagar	135.30	1079.58
		(5.08)	(40.58)
7.	Outram Lines	1486.81	1033.48
		(991.20)	(688.98)
8.	Arya Pura	−1993.21	−3076.11
		−(376.78)	−(581.49)
9.	Civil Lines	−767.99	−503.68
		−(11.96)	−(7.85)
10.	Kalkaji	−61.75	−137.41
		(2.60)	−(5.80)
11.	Vasant Vihar	−388.57	−546.21
		−(2.25)	−(3.16)
12.	East Rohtas Nagar	−790.13	714.07
		−(44.14)	(39.89)
13.	Sadar Cantt. (Delhi-Cantt.)	107.70	423.04
		(3.66)	(14.40)
	Model	(11)	(12)

NOTE

1. The residuals indicate the differences between the observed and predicted values of the dependent variable (Rateable value) from the respective equations of linear regression models.
2. Figures in parenthesis indicate percentages and others indicate amount in rupees.

TABLE 20 VALUES OF RESIDUALS FOR EACH LOCALITY : RENTAL VALUE WITH RESPECT TO ENVIRONMENTAL FACTORS

Sl. No.	*Name of the Locality*	*Residuals of*	
		$X_1, X_2, X_3, X_4, X_5, X_6, X_7$ *on* Y_2	$X_1, X_2, X_3, X_4, X_5, X_6$ *on* Y_2
1.	Moti Nagar	−3102.12	−2806.26
		−(173.49)	−(156.94)
2.	Basti Harfool Singh	2398.72	4217.04
		(97.50)	(171.42)
3.	Janak Puri	537.36	1241.56
		(5.89)	(13.61)
4.	Baird Road	2412.37	3046.48
		(9.27)	(11.71)
5.	Ganj Mir Khan	−2552.87	−4295.57
		−(142.77)	−(240.24)
6.	Old Rajendra Nagar	1875.58	592.81
		(37.57)	(11.87)
7.	Outram Lines	2071.16	2687.00
		(185.58)	(240.77)
8.	Arya Pura	−4359.98	−2888.89
		−(595.62)	−(394.65)
9.	Civil Lines	−860.40	−1213.46
		−(8.31)	−(11.78)
10.	Kalkaji	445.35	548.12
		(11.21)	(13.79)
11.	Vasant Vihar	−444.24	−230.10
		−(1.73)	−(0.89)
12.	East Rohtas Nagar	1,139.32	−904.09
		(44.99)	−(35.70)
13.	Sadar Cantt. (Delhi-Cantt.)	439.77	11.39
		(17.04)	(0.44)
	Model	(14)	(13)

NOTE

1. The residuals indicate the differences between the observed and predicted values of the dependent variable (Rental value) from the respective equations of linear regression models.
2. Figures in parenthesis indicate percentages and other indicate amount in rupees.

TABLE 21 VALUES OF RESIDUALS FOR EACH LOCALITY : LAND VALUE WITH RESPECT TO ENVIRONMENTAL FACTORS

Sl. No.	*Name of the Locality*	*Residuals of*	
		$X_1, X_2, X_3, X_4, X_5, X_6, X_7$ *on* Y_3	$X_1, X_2, X_3, X_4, X_5, X_6$ *on* Y_3
1.	Moti Nagar	105.84	34.45
		(23.51)	(7.65)
2.	Basti Harfool Singh	104.43	211.71
		(11.60)	(23.52)
3.	Janak Puri	50.41	81.99
		(16.80)	(27.32)
4.	Baird Road	—3.67	73.83
		—(0.48)	(9.84)
5.	Ganj Mir Khan	—93.63	—202.90
		—(23 40)	—(50.72)
6.	Old Rajendra Nagar	—164.43	—149.35
		—(32.88)	—(29.87)
7.	Outram Lines	3.48	71.70
		(1.11)	(23.90)
8.	Arya Pura	144.77	171.28
		(34.96)	(24.46)
9.	Civil Lines	—10.78	—41.80
		—(2.08)	—(7.96)
10.	Kalkaji	—1.98	11.97
		—(0.43)	(2 65)
11.	Vasant Vihar	30.79	24.93
		(5.25)	(4.30)
12.	East Rohtas Nagar	—214.92	—237.91
		(122.80)	—(135.95)
13.	Sadar Cantt.	—50.17	—49.88
	(Delhi-Cantonment)	—(25.08)	—(24.93)
	Model	(16)	(15)

NOTE

1. The residuals indicate the differences between the observed and predicted values of the dependent variable (Land value per square metre) from the respective equations of linear regression models.
2. Figures in parenthesis indicate percentages and others indicate amount in rupees.

TABLE 22 VALUES OF RESIDUALS FOR EACH LOCALITY : RATEABLE VALUE WITH RESPECT TO ENVIRONMENTAL FACTORS

Sl. No.	*Name of the Locality*	*Residuals of*	
		X_1, X_2, X_3, X_4 Y_5, X_6, X_7 *on* Y_1	X_1, Y_2, X_3, X_4, X_5, X_6 *on* Y_1
1.	Moti Nagar	−423.50	−1161.33
		−(40.72)	−(111.66)
2.	Basti Harfool Singh	− 45.72	−588.18
		−(2.39)	−(30.87)
3.	Janak Puri	4493.94	4771.59
		(64.80)	(68.80)
4.	Baird Road	4450.08	3864.86
		(24.57)	(21.34)
5.	Ganj Mir Khan	−197.64	293.21
		−(13.82)	(20.50)
6.	Old Rajendra Nagar	237.39	915.72
		(8.92)	(34.42)
7.	Outram Lines	−34.25	−66.98
		−(22.83)	−(44.65)
8.	Arya Pura	30.02	−356.45
		(5.67)	−(67.38)
9.	Civil Lines	−475.63	189.74
		−(7.41)	(2.95)
10.	Kalkaji	−161.30	−534.66
		−(6.81)	−(22.57)
11.	Vasant Vihar	−8379.77	−11813.03
		−(48.55)	−(68.45)
12.	East Rohtas Nagar	−1259.78	175.06
		−(70.37)	(9.77)
13.	Sadar Cantt. (Delhi-Cantt.)	735.68 (25.05)	1043.05 (35.52)
	Models	(18)	(17)

NOTE

1. The residuals indicate the differences between the observed and predicted values of the dependent variable (Rateable value) from the respective equation of Cobb-Douglas regression models.
2. Figures in parenthesis indicate percentages and others indicate amount in rupees.

TABLE 23 VALUES OF RESIDUALS FOR EACH LOCALITY: RENTAL VALUE WITH RESPECT TO ENVIRONMENTAL FACTORS

Sl. No.	*Name of the Locality*	*Residuals of*	
		$X_1, X_2, X_3, X_4, X_5 X_6$ & X_7 *on* Y_2	X_1, X_2, X_3, X_4, X_5 & X_6 *on* Y_2
1.	Moti Nagar	− 652.76	−1488.20
		− (36.50)	−(83.23)
2.	Basti Harfool Singh	321.45	−92.47
		(13.06)	−(3.75)
3.	Janak Puri	4282.79	4686.15
		(46.96)	(51 38)
4.	Baird Road	7630.95	7066.17
		(29.33)	(27.16)
5.	Ganj Mir Khan	−1018.13	−378,24
		−(56.94)	−(21.15)
6.	Old Rajendra Nagar	1347.69	2116.33
		(26.99)	(42.39)
7.	Outram Lines	129.37	5.92
		(11.59)	(0.53)
8.	Arya Pura	− 214.25	−698.93
		−(29.26)	−(95.48)
9.	Civil Lines	−3775.14	−2778.26
		−(36.49)	−(26.85)
10.	Kalkaji	587.75	234.51
		(14.79)	(5.90)
11.	Vasant Vihar	−7060.99	−10158.89
		−(27.58)	−(39.68)
12.	East Rohtas Nagar	−1124.71	220.01
		−(44.41)	(8.68)
13.	Sadar Cantt. (Delhi-Cantt.)	512.81	725.36
		(19.87)	(28.11)
	Model	(20)	(19)

NOTE

1. The residuals indicate the differences between the observed and predicted values of the dependent variable (Rental value) from the respective equations of Cobb-Douglas regression models.
2. Figures in parenthesis indicate percentages and others indicate amount in rupees.

TABLE 24 VALUES OF RESIDUALS FOR EACH LOCALITY : LAND VALUE WITH RESPECT TO ENVIRONMENTAL FACTORS

Sl. No.	*Name of the Loaclity*	*Residuals of*	
		$X_1, X_2, X_3, X_4, X_5, X_6$ & X_7 *on* Y_3	X_1, X_2, X_3, X_4, X_5 & X_6 *on* Y_3
1.	Moti Nagar	50.33	137.98
		(11.18)	(30.66)
2.	Basti Harfool Singh	166.82	177.80
		(18.53)	(19.75)
3.	Janak Puri	51.06	−34.32
		(17.01)	−(11.43)
4.	Baird Road	115.48	27.70
		(15.39)	(3.69)
5.	Ganj Mir Khan	−196.98	−151.93
		−(49.24)	−(37.98)
6.	Old Rajendra Nagar	−35.81	−171.34
		−(7.16)	−(34.26)
7.	Outram Lines	41.48	40.92
		(13.82)	(13.64)
8.	Arya Pura	149.59	281.53
		(21.36)	(40.21)
9.	Civil Lines	−108.81	−50.06
		−(20.72)	−(9.53)
10.	Kalkaji	62.06	52.28
		(13.79)	(11.61)
11.	Vasant Vihar	−13.92	61.30
		−(2.42)	(10.66)
12.	East Rohtas Nagar	−123.25	−134.54
		−(70.42)	−(76.87)
13.	Sadar Cantt.	0.00	−28.90
	(Delhi-Cantt.)	(0.00)	−(14.45)
	Model	(22)	(21)

NOTE

1. The residuals indicate the differences between the observed and predicted values of the dependent variable (Land value) from the respective equations of Cobb-Douglas regression models.
2. Figures in parenthesis indicate percentages and other indicate amount in rupees.

2. The market land value is not reflected in the assessed rental value because it is not the market rent but the actual rent being paid by the tenants. The rental value thus accounts for only 12 per cent variation in land value and a sizable proportion of incremental in rental value remains concealed in terms of underquotation of rental value or transacted through pugree (a sort of underhand transaction) putting the public exchequer to a loss.
3. Land value is the capitalised value of land and rental value is a certain percentage of the capital value. Then there is no reason to believe that the rateable value should not keep pace with the rising rental value, when the overall land and property values are showing an increasing trend. Since 'rateable value' fails to keep pace with rising rents, the valuation of property on 'capital value' basis seems to be more reliable.
4. Measuring the contribution of 'environmental' and 'amenity' factors, the study indicates the desirability of a certain minimum distance in the planning of residential neighbourhood and shopping centre.
5. Since the growth multiplier of land values is greater than that of rental values, it is likely to induce pressures for economy in land-use which gets reflected in the increased density of capital and more properties per unit of space and thereby increasing the efficiency of space. This further creates scope for appraisal of appropriation rates, in terms of the net rent received by landlords divided by the total economic rent of the land or building property.
6. However, the findings of this study make a case for some of more important variables and quantify their contributions which have direct bearing on decision-making process and policies relating to rentals, land and rateable property values, urban land control measure, housing policies including residential locations and planning of activities for a more humane environment.

5. BROAD CONCLUSIONS AND POLICY IMPLICATIONS

In an attempt to measure the contribution of 'environmental' and 'amenity' factors on land and property values for knowing : (*i*) how and in relation to what factors did actual land value, rental value and rateable value vary, and (*ii*) how this variation is useful for policy implications, the study in a sharp focus brings out vast variations and 'gaps' in land and property values in Delhi during 1977-78. The results strongly support the hypothetical assumptions that the property value is determined by the environmental quality of specific locations loaded with 'services' and 'amenities', in general and by considerations of 'accessibility-space-transportation costs, in particular.

The success of land value model helps confirm the theoretical account and the contribution of the factors under consideration more than rental value and rateable value models. The implications of the alternative models suggest that it is the land value which gives much hypothesised relations with significant signs. However, the residential choice in terms of environmental quality including housing characteristics is much more complex problem which calls for a behaviourist theory and socio-economic data on household income and expenditure pattern at micro-level.

Since decisions on location and siting of economic activities and investment on social overheads of specific land-uses have an everlasting effect on the pattern and structure of urban land values and emerging settlements within the city and towards the periphery, the study also throws some light on the 'gaps' and 'inequities' in the environmental 'services' and 'amenities' through an analysis of the growth of capital expenditure *vis-a-vis* urban development effort in Delhi by sectors and by development agencies during 1970-75. And how the growth of environmental structure has kept pace with the growth of population, income and per capita income has also been analysed in terms of elasticity of each factor. Broad conclusions emerging from the study and their policy implications are given below.

1. The assessed rateable value of property is directly affected by rental value. An increase in rental value of a rupee will increase the rateable value by 0.68 paise only; whereas conversely, an increase in the rateable value of a rupee will increase the rental value by Rs. 1.45. But in terms of elasticity, it explains that rateable value is more elastic (more than unity) to changes in rental value than rental value (less than unity) to changes in rateable value.

Implications

It implies that propensity to change in rental value is more than rateable value since rental value is less elastic to changes in rateable value. Although both change significantly with respect to each other, the absolute increase in rateable value is less than the rental value which has a tendency to increase at a much higher rate. In the event of an increase in rateable value of a rupee, the landlords have a tendency to increase the rental value by Rs. 1.45. This shows an exploitation of the situation by the landlords and the miserable plight of the tenants who are disorganised in the urban land market and cannot dictate their own terms. And the whole urban land market is regulated by the strong lobbying of landlords having full grip over the situation proving government machinery ineffective in terms of partial rent control and other tax measures in enhancing the property values. In the absence of any other more flexible fiscal measures, recourse to property taxation distorts the urban land market. Since rentals are less elastic to changes in rateable values, every bit of increase in property value proportionately leads to a more sympathetic rise in rental values which becomes an additional source for further distrotions in the market.

2. The rental value is directly affected by increases in land values. For one rupee change in rental value, the land value changes by Rs. 13.85 but if land value changes by one rupee, the rental value changes by less than a paise (*i.e.*, Rs. 0.0083). It is so because the market land value is not reflected in the rental value, since it is the actual rent being paid by the tenants and not the market rent. Hence rental value accounts for only 12 per cent variation in land value and a sizable

proportion of incrementals in rental value remains concealed in terms of under quotation or transacted through 'pugree' (a sort of underhand transaction).

Implications

There is no reason to believe that the rateable value should not keep pace with the rising rental value, when the overall land and property values are showing an increasing trend. Since land value is the capitalised value of land and rental value is a certain percentage of the capital value, it suggests for the valuation of property on the basis of 'capital' value when rateable value fails to keep pace with rising rents. It simply indicates that the urban land market in Delhi is so tight that it accounts for a sizable proportion of rental value being transacted through speculative deals or under hand transactions. Since land value hikes are not truly reflected in the accounted rental value taken for the assessment of property values(being paid by the tenants), it shows imperfection in the urban land market of Delhi where partial measures like the operation of rent control, development and disposal of land and built up flats by the Delhi Development Authority, the subsidised housing by the Government and Semi-Government sectors and some of the public bodies have failed to control and regulate the urban land market. And at the same time, ineffectiveness of rent control measures have reduced the amount of public funds available from taxation and have led to the deterioration of such housing stocks also. It is, therefore, suggestive of evolving urban land value policies which should be integrated with urban land and housing policies to make equi-distribution and prevent the unskewed distribution of urban land resources.

3. The contribution of some of the environmental factors on rateable value of property can be significantly explained in terms of occupancy rate, distance from residence to shopping centre and to place of work which account for about 68 per cent variation in rateable value. Access to place of employment within urban Delhi seems to be an important determinant of property value. An increase in the distance from residence to place of work by a kilometre, decreases

rateable value by Rs. 1.50 and by increasing occupancy rate by one person, the rateable value decreases by Rs. 2.31. But an additional bus service in the locality enhances the rateable value by 0.89 paise, and by locating shopping centre at a minimum desirable distance, the property value gets enhanced by 0.56 paise. The land value has no impact on the incrementals in property value because there is no direct relation between the two. The property value does not catch up family income.

Implications

The implication of a positive sign with respect to distance from residence to shopping centre indicates the desirability of certain minimum distance in planning the residential neighbourhood and shoopping centre. This is an important lesson and guideline for planners in the placement of activities over the space. The other implications that could be drawn from the conclusion are that a well located area with rich environmental services and amenities can command a high property value. To what extent the availability of amenities and adding of services can increase the value of property, the study enlightens the decision maker in these directions.

4. Since property value in terms of assessed rateable value account for 99 per cent variation in the rental value, there is no significant difference in the behaviour pattern of rateable value and rental value. In both the cases, the role of 'environmental' and 'amenity' factors in the variation of these values is more or less the same. But in the total variation of rental value, the marginal contribution of the CBD (centrality of the node) increases significantly along with other environmental factors. Like the centrality of the node, occupancy rate is also more catchy and accounts for 57 per cent variation in the rental value but land value contributes only 5 per cent variation in rental value.

Implications

The emerging conclusion of the contribution of 'environmental' and 'amenity' factors on rental value indicate that an increase in occupancy rate not only minimises the per capita

availability of civic services with more pent up demand degrading the quality of environment but also decreases the rental value of the property. However, land and property values and densities no longer decline everywhere with distance from the original CBD. There are local peaks surrounding other centres (sub-nodes) due to 'confounding effect' of residential values with commercial values. The examples of these local peaks are the recent coming up of Nehru Place in South Delhi and Rajendra Place in West Delhi which have given an impetus to the residential and commercial values in the vicinity of the area. Since the 'growth multiplier' of land values is greater than the growth multiplier of rental values, it is likely to induce pressures for economy in land-use which gets reflected in the increasing density of capital and properties per unit of space. The recent coming up of huge skyscrapers in the Connaught Place area have added enormous values to the land and property of the CBD. This has increased further scope for the appraial of appropriation rate in terms of the net rent received by landlord divided by the total economic rent of the land or building property which will be an additional source of revenue to the municipal government.

5. The environmental factors selected for the study contribute significantly and more sensibly to land value as they show expected signs of the hypothesised relations, and also justify the selection of explanatory variables in the models.

Implications

The main implication of the goodness of the 'fit' of the model suggests that the operation of the specified environmental factors in the model is more effective and catchy which contributes significantly and sensibly to the variation of land values. Since land values most often become constraint in the allocation of resources, inharmonious growth in environmental structure can further distort the urban land market. Therefore, public control of land-use becomes indispensible for the achievement of the longterm objectives and policies for the growth and development of human environment which impose new responsibilities upon urban government and administration.

6. The analysis of residuals indicates the amount of rental value, property value and land value which has not been explained by the explanatory variable (the specified variables) in the regression model. In other words, it explains the gap or the extent to which each locality under study deviates from the expected property value, rental value and land value with respect to single factor average regression line or with multiplicity of environmental factors.

Implications

The policy implication of this conclusion lies in indicating the gaps in actual and estimated land value, rental value and rateable value in each locality both with reference to its (dependent) base as well as with reference to the environmental quality of the locality which provide a positive basis for normative decision in the valuation and appraisal of properties. But the end product of revaluation should not be the taxation for raising more revenue resources for the community. Rather, it should act as a powerful tool to exercise controlling effect on urban land market to redistribute to the community at large the benefits of unearned increment in rentals, land and property values. These private gains arise due to public spending incurred on the provision of more services and amenities to the area.

7. Although there has been tremendous growth in capital expenditure, its skewed channelisation have marred the urban planning process which is evident from the expenditure on social welfare and transport (stock rolling) 400 per cent, transport (fixed) 117 per cent and telephones 111 per cent. The corresponding growth in water supply, electricity, drainage, etc., was quite high. But expenditure on land development, roads and bridges indicated a very nominal growth rate. However, negative growth rate has been noticed in case of slum development and public safety, while housing, slum improvement in J.J. Colonies, parks and playgrounds, building, etc., account for lower negative growth rate.

Implications

The implications drawn from this conclusion indicate that with the growth of population in Delhi, transport sector, social welfare, telephones, water supply, electricity and drainage got the massive support of the Government. The elasticity of growth of capital expenditure in these sectors was positive and above unity in all the cases. But the growth of capital expenditure on buildings, shops, markets, commercial enterprises, parks and playgrounds, public safety, and slum development did not receive much attention as the growth in these sectors indicated negative elasticity above unity with respect to population. The high elasticity of growth of capital expenditure with respect to population, income and per capita income indicates an element of bias towards the growth of services and amenities meant for 'better-offs' only or to improve the services in better-off areas alone. There seems to have been no intention of giving additional inputs to new areas but adding more and more to the land and property values of the existing areas. As a consequence, the investment for the creation of new land inventory has been lacking implying thereby a widening gap between demand and supply creating further distortions and scarcity in land market.

8. The exponential growth in capital expenditure incurred by different agencies and departments was positive and very high ranging between 15-28 per cent in the case of Railways, Delhi Transport Corporation, Delhi Telephones, Delhi Electricity Supply Undertaking and Delhi Water Supply and Sewerage Disposal Undertaking, all in descending order. While the capital expenditure by Delhi Development Authority was growing at the rate of 2.28 per cent, public works department of Delhi Administration, Municipal Corporation of Delhi, Delhi Cantonment, New Delhi Municipal Committee, Central Public Works Department, have shown negative growth rates.

Implications

The non-correspondence of growth in capital expenditure in the provision of essential municipal services together with the development and disposal of land implies the lack of proper

coordination and programming in capital budgeting by different agencies for the harmonious growth of environmental structure of Delhi. This reveals the 'gaps' and 'inequities' in the development efforts to better the quality of life of its people. The imminent differentials in the distribution of 'services' and 'amenities' and lags in the development and disposal of land have created imperfections and distortions in the use of land and its market. This calls for more effective cooperation and coordination among the development agencies responsible for plan implementation than they are at present.

9. The overall exponential growth of capital expenditure on environmental structure in Delhi during 1970-75 was 6.25 per cent as against 4.21 per cent in population and 15.57 per cent in income.

Implications

The significance of the growth in population, income and capital expenditure on the growth of environmental structures implies that the income growth in Delhi has been tremendous and four-fold, more than the population growth. The corresponding growth in environmental structure has been more than the population growth. Both the income and capital expenditure on environmental structure have shown higher growth rates as compared to growth in population. If something is lacking and not matching the needs of the population growth, it is not due to lack of resources but due to faulty allocation of resources and their distribution policies.

SUGGESTED RESEARCH AREAS

In metropolitan cities like Delhi, the rentals and urban land values are very high and have shown continuous increasing trends. To all families, rich and poor both, land for housing is essential, but more so for employment, infrastructure and social services and amenities. But the increasing trends in land prices become constraint in the allocation of resources in the implementation of development programmes particularly in the habitation and rehabilitation of the 'urban poor'. The several factors that affect the availability of land in urban areas are

the inflationary pressures of growing environment, boom psychology, tendency to hold land for speculative gains and creating a gap between demand and supply, the uncertainty about the future developments enunciated in the land-use plans, delays in government decisions, and above all, the low pace in delivery of services commensurate with the growth in population and development and disposal of land. These factors are also responsible for creating imperfections and distortions in the urban land market. How urban land market is being affected by these factors and how public investment is adding more and more to the value of land and property together with the general growth of community are some of the areas for further research. If a comprehensive study is designed and conducted at a larger plane taking into account the aforesaid variables, a very sensible model could be constructed. In addition to these, an inventory of urban data relating to urban land and prices for the construction of indices for the urban land values, rental values and above all, property values with definite base are most important areas of research. The construction of each index becomes a separate project in itself on a long term basis.

APPENDICES

APPENDIX I

ASSESSMENT PROCEDURE OF RATEABLE VALUE OF PROPERTY BY MUNICIPAL CORPORATION OF DELHI

Under the Act[1] the rateable value of any land or building shall be the annual rental which such land or building might reasonably be expected to let from year to year. The rateable value of a building shall include the rateable value of land and such other furniture and fixtures as are considered necessary for the use and enjoyment of the building for the purposes for which they are intended to be used.

(*a*) *Rented Properties*

1. Where the property is on rent, the rent actually paid by the tenant is deemed to be the gross annual rent and the rateable value is determined accordingly unless the tenant is a relative or an employee of the owner or the declared rent is otherwise considered as concessional or collusive. In case declared rent is not accepted, resort is made to the rental data as fixed by the department. This is arrived at on the basis of the actual rents prevailing in that area based on inspection of certain properties taken at random. The rental data is fixed with reference to the carpet area.

1. (*i*) From the rateable value so determined, an allowance of 10 per cent is made towards the cost of repairs/insurance, etc. Rebate at the rate of Rs. 5 per fan, Rs. 10 per geyser or booster pump per month is allowed only if the assessee has provided these amenities to the tenant and the rent is inclusive of these facilities.

1. (*ii*) Carpet area is generally worked out on the following basis.

All rooms including covered or glazed verandah or whatever size are taken at their actual measurement. Mianis, passages and open verandahs of whatever size and pantry and kitchen wherever these are less than 100 sq. ft., will be

[1]Municipal Corporation of Delhi Act. 1957.

taken at 50 per cent of the actual measurement. Lofts, space under stairs, bath-rooms, latrines, etc., are excluded.

2. Annual value of properties which are on rent, but the rent of which is not known or is not disclosed by the owner or the tenant is also determined on the basis of the approved rental data or on comparison with other similar properties in the locality.

3. Standard Rent : In cases in which rent of the property has been fixed in accordance with the provisions of Rent Control Act, standard rent so fixed is taken to be gross fair rent.

4. Sublet properties : In case a property is let out to a tenant who has further sublet it and the rent paid by the sub-tenant is more than what is being paid for the purpose of determining the rateable value.

(*b*) *Self-Occupied Properties*

In the case of self-occupied properties, if it has never been let out earlier and it is a case of first assessment, the rateable value shall be determined with reference to the cost of con struction and the capital value of the land on the date of commencement of construction. This is done at $7\frac{1}{2}$ per cent of the total cost in case the rent comes to less than Rs. 1,200 per annum and $8\frac{3}{8}$ per cent in other cases.

2. In case where the property was earlier let and the owner subsequently occupies it for self-use, the method still is to take the reteable value on the basis of rent which the property was fetching while it was rented and allow self-occupancy rebate at the permissible rate which shall be between 15 to 25 per cent for and up to assessment year 1977-78 and at the rate of 20 per cent from April 1, 1978 onwards.

3. Plot of land : If it is a plot of land capable of being built upon or on which a building is in process of creation, its rateable value shall be fixed at 5 per cent of the estimated capital value of such land.

(*c*) *Assessment of Properties with Rateable Value* of *Rs. 2,000 or less*

In order to facilitate the early disposal of such cases, a simplified procedure has been evolved and such assessments

will hereafter be completed in a summary manner and as far as possible without calling the assessees or if called, on agreed basis.

On Whom Levied :

The property tax is primarily leviable :

(*a*) Upon the lessor, if the land or building is let;

(*b*) Upon the superior lessor, if land or building is sublet;

(*c*) Upon the person in whom the right to let vests if the land and building is unlet.

2. If any land was let for more than one year to a tenant and such tenant has built upon that land, the property tax in respect of such land and building shall be levied upon the tenant, whether the lands and buildings are in the occupation of such tenant or a sub-tenant of such tenants.

3. If a building is severally owned in parts of flats or rooms, the liability of the several owners of the building for payment of property tax is joint and several.

Property Taxes :

(*i*) Fire Tax at the rate of $\frac{1}{2}$ per cent of the rateable value of lands and buildings.

(*ii*) General Tax :

(*a*) In the rural areas as defined in Section 2(52) at 3 per cent of the rateable value of lands and buildings occupied for residential purposes but let out on rent at $4\frac{1}{2}$ per cent on the rateable value of lands and buildings or portions of lands and buildings occupied for such trades and business as are referred to in Sections 416, 417, 421 and 422 of the Act.

(*b*) (*i*) In urban areas lands and buildings except as otherwise defined in para (*b*) (*ii*) and (*iii*) below, the General Tax be levied as under :

Rateable Value of Lands and Buildings	*Rate of General Tax*
Up to Rs. 1,000	10 per cent.
Over Rs. 1,000 to 2,000	Rs. 100 plus $11\frac{2}{3}$ per cent of the amount by which the rateable value exceeds Rs. 1,000.
Over Rs. 2,000 to 5,000	Rs. 215 plus $12\frac{1}{2}$ per cent of the amount by which the rateable value exceeds Rs. 2,000

Over Rs. 5,000 to 10,000	Rs. 590 plus 15% of the amount by which the rateable value exceeds Rs. 5,000.
Over Rs. 10,000 to 15,000	Rs. 1,340 plus 18% of the amount by which the rateable value exceeds Rs. 10,000.
Over Rs. 15,000 to 20,000	Rs. 2,240 plus 20% of the amount by which the rateable value exceeds Rs. 15,000.
Over Rs. 20,000 to 25,000	Rs. 3,240 plus 25% of the amount by which thc rateable value exceeds Rs. 20,000.
Over Rs. 25,000	Rs. 4,490 plus 30% of the amount by which the rateable value exceeds Rs. 25,000.

(*b*) (*ii*) Within the urban areas land and buildings of portions thereof occupied by or used for purposes of cinema houses, residential hotels, manufacture of textiles, rayons, silk and woollen fabrics (this will include all cases where man-made fibre is used and exclude khadi), manufacture of chemicals and dye-stuffs including insecticides and disinfectants, manufacture of cement pipes, sheets, manufacture of tyres or retreading thereof, body-building on chassis of motors, buses, including all three wheeler motor vehicle and trucks, all auto repair or reconditioning workshops, steel re-rolling, metal rolling mills, flour mills (excluding chakki, running in shops), cold-storages, ice-factory, aerated water factory, railway wagon building factory or factories engaged in reconditioning of railway wagons, pottery, petroleum installations, diesel oil or other lubricants including storage and tanks, petrol, diesel oil and kerosene oil, pumps and service stations, insurance and banking business including godowns, stock exchanges and electricity (generation and distribution), special higher rate of the general tax be levied.

Up to Rs. 2,000	15 per cent.
Over Rs. 2,000 to 5,000	Rs. 300 plus 18 per cent of the amount by which the rateable

Over Rs. 5,000 to 10,000	Rs. 840 plus 22% of the amount by which the rateable value exceeds Rs. 5,000.
Over Rs. 10,000 to 15,000	Rs. 1,940 plus 26% of the amount by which the rateable value exceeds Rs. 10,000.
Over Rs. 15,000 to 20,000	Rs. 3,240 plus 28% of the amount by which the rateable value exceeds Rs. 15,000.
Over Rs. 20,000	Rs. 4,640 plus 30% of the amount by which the rateable value exceeds Rs.20,000.

(*b*) (*iii*) Within the urban areas land and buildings or portions thereof occupied by or used for purposes of restaurants, eating houses including snack bars, all types of guest houses, nursing homes, vocational schools, other teaching institutions run on commercial lines, chakkies running in shops or where any other business or manufacturing activity is carried on including journalistic or printing establishments or shops of all descriptions and trades or operations connected with trades specified in Part I of Eleventh Schedule to the D.M.C. Act, 1957 excluding those mentioned in paragraph (*b*) (*ii*) above, or all office premises (excluding consulting rooms of the registered medical practitioners and practising lawyers which form part of their residential premises), ordinary higher rate of general tax be levied as under :

Up to Rs. 2,000	15%.
Over Rs. 2,000 to 10,000	Rs. 300 plus 18% of the amount by which the rateable value exceeds Rs. 2,000.
Over Rs. 10,000 to 15,000	Rs. 1,740 plus 20% of the amount by which the rateable value exceeds Rs. 10,000.
Over Rs. 15,000 to 20,000	Rs. 2,740 plus 23% of the amount by which the rateable value exceeds Rs. 15,000.
Over Rs. 20,000 to 25,000	Rs. 3,890 plus 27% of the amount by which the rateable value exceeds Rs. 20,000.

Over Rs. 25,000	Rs. 4,240 plus 30 per cent of the amount by which the rateable value exceeds Rs. 25,000.

(*iii*) Water Tax :

5 per cent of the rateable value of the lands and buildings.

(*iv*) Scavenging Tax :

(1) (*a*) Hotels & Restaurants, Clubs, Ice—5 per cent of the rateable value of the factories and Cinemas.

(*b*) Other large non-residential premises 2½ per cent of the rateable value having 1 in. and above water connections thereof.

Connection or ½ in. water connection plus private source of water, or more than one ½ in. water connections.

(2) Lands and other buildings not specified in (1) 11 per cent of the rateable value thereof.

The lands and buildings, the rateable value of which does not exceed Rs. 100 per annum are exempted from the payment of Scavenging Tax.

PROFILE OF THE LOCALITIES[1]

Moti Nagar

A residential colony in West Delhi, had a population of 18,214 as of 1971, and a density of 26,785 persons per sq. km. The average size of family is 5.38 with an occupancy rate of 2.07 persons per room. The income-structure places the residents in the middle income group and their monthly income varies between Rs. 300 to Rs. 2,500 with a per capita income of Rs. 160.70 p.m. The housing structure is not very good (as they were constructed in a hurry by the Ministry of Rehabilitation after the partition of the country) except for those which have recently come up or have been renovated by the occupants.

The social and economic infrastructure of the locality is quite satisfactory. The area is electrified with power transmission lines. The supply of water is 12 hours a day. The number of buses available in an hour for going to different directions is 14 and about 55 per cent of the head of households use public transport for going to their places of employment. As regards the services like health and education, they are available at distance of 0.24 km. and 1.52 kms., respectively.

The urban amenities like shopping centre is close by to the locality (0.35 km). There is no district park and the area has dense population. The average distance of the CBD is 10.37 kms. well connected by road and transportation facilities. Considering these environmental conditions, the locality has an average annual rental value of the property of Rs. 1798 as against an assessed rateable value of Rs. 1040. The notional market value of land per sq. metre is Rs. 450 although no vacant land is available.

[1]The information in this profile of localities is based partly on our field survey and partly on the report, *Distribution & Differential Location of Public Utilities in Urban Delhi*, Indian Institute of Public Administration, 1978.

Basti Harfool Singh

A locality with mixed land-use in the North Delhi had a population of 18,178, as of 1971 census and a density of 28,405 persons per sq. km. The average size of family is 5.88 with an occupancy rate of 2.41 persons per room. The income structure places the residents mainly in the middle and high middle income groups and in some cases it is as high as Rs. 3,500 per month and above. The per capita income is Rs. 250 p.m. The housing structure although quite old (more than 40 years) is upto the mark.

The social and economic infrastructure of the locality is quite satisfactory. The whole area is electrified with power transmission lines and is well connected by road and public transportation to all parts of the city. In an hour about 15 buses are available for going out of the locality. About 15 per cent of the heads of households use public buses for going to their places of employment. The water supply is available in the locality for about 11 hours in a day but the pressure is quite low. As regards the services like health and education, these are available in the locality at an average distance of 1.5 km. and 1.20 kms. respectively. The urban amenities like shopping centre is very close to the locality (0.08 km). There is no district or colony park in the locality although the area is densly populated. The average distance from the residence to the Central Business District is only 3.12 kms. Considering these environmental conditions, the locality has an average annual rental value of the property as (very low with) Rs. 1,905 per property. The notional market value of land is as high as Rs. 900 per sq. metre.

Janak Puri

A residential colony being developed by Delhi Development Authority (DDA) for about a decade or so, comprises of Janta, low income and middle income group houses constructed by DDA and private houses on land auctioned by DDA. The present population of the locality is estimated at 85,000[2] persons with a density of 8,000 persons per sq.km. The average

[2]Estimated on the basis of average family size and the number of built up flats and privately constructed houses.

size of family is 5.01 with an occupancy rate of 1.18 persons per room. The income structure places the residents in the middle income group with an average monthly family income of Rs. 1,174.67 p.m. and the per capita income of Rs. 234.31. The housing structure is very good and modern.

The social and economic infrastructure of the locality is quite satisfactory except that the municipal water supply is not adequate and is available only for 3 hours in a day. The average number of DTC buses available in an hour for going out of the locality is 10. About 36 per cent of the heads of households interviewed use public buses for going to their places of employment and the average distance travelled is as high as 20.60 kms. each way. As regards the services like health and education, they are available in the colony at a distance of 0.21 km. and 1.93 kms. respectively. Almost each pocket and block in the colony is provided with parks and playgrounds. The urban amenities like shopping centre in the locality is at a distance of 0.25 km. and the Central Business District is quite far away at a distance of 18.07 kms. As the construction is new, the average annual rental value per property is Rs. 9,120 and an assessed rateable value of Rs. 6,935. The notional market value of land is Rs. 300 per sq. metrer.

Baird Road

A locality with mixed land use having a sizable number of shops and buildings has been mainly constructed either by NDMC or by Central Government. There are only 998 private properties in the colony on which the property tax is being levied. Taking all the private properties and the Government flats, the colony had a population of 12,445 persons as per 1971 census and a density of 8,890 persons per sq. km. The average size of family is 5.00 with an occupancy rate of 1.94 persons per room. The income structure places the residents of the locality into middle and higher income groups and the average monthly family income works out to Rs. 812.14 with a per capita income of Rs. 162.43.

The social and economic infrastructure of the locality is very good. The whole area is well connected by roads and public transportation to all parts of the city. The locality is located very near to the central business district of the city

(Connaught Place) which is only at a distance of 0.66 kms. The water supply is available in the colony for about 9 hours a day. As regards the services like health and education, these are available within the locality and residents have not to go out. The colony's district park is only at a distance of 0.80 kms. which is nothing but the central park of the Connaught Place. Considering these environmental conditions, the locality has an average annual rental value[3] of Rs. 26,016 as against an assessed rateable value of Rs. 18,108 per property. The notional market value of land is Rs. 750 per sq. metre which seems to be an underestimate considering the centrality of the locality.

Ganj Mir Khan

A locality with mixed land-use in the core area of the city of Delhi had a population of 20,704 and a very high density of 57,510 persons per sq. km. as of 1971 census. The average size of the family is 6.57 with an occupancy rate of 2.61 persons per room. The income structure places the residents mainly in lower and middle income group with an average monthly family income of Rs. 604.29 and a per capita income of Rs. 91.96. The housing structure is very old and dilapidated full of congestion. The area has also been declared as the slum area by the Master Plan. The whole area is electrified with power transmission lines and is well connected by roads and public transportation. About 14 buses (DTC) are available for going out of the locality in an hour to different directions and 31.43 per cent of the heads of household interviewed used public buses for going to their places of employment. The water supply is available in the locality for about 6 hours in a day but the pressure on upper floors is very low.

The urban amenities like shopping centre, education facilities, health services, parks and community centre are available nearby or within the locality. The locality is adjacent to one of the biggest shopping centre of India, *viz.*, Chandni Chowk a

[3]Only the private houses have been taken into consideration. The occupants of the government owned flats do not pay the property tax, as their accommodations are not subject to assessment. And hence 35 sample households were substituted by privately owned houses.

sub-CBD of Delhi. The central business district (Connaught Place) is at a distance of 2.31 kms. only. The roads and lanes in the colony are very narrow and the houses in the locality do not get even sufficient sun light. In view of these environmental conditions, the locality has an average annual rental value of Rs. 1,788 as against the assessed rateable value of Rs. 1,430 per property. The notional market value of land is Rs. 400 per sq. metre.

Old Rajendra Nagar

It is mainly a residential colony in West Delhi which has come up in the post independence period had a population of 21,757 and a density of 31,620 persons per sq. km. as of 1971 census. The average size of a family is 5.76 with an occupancy rate of 1.83 persons per room. The income structure places the residents mainly in the middle income group with an average family income of Rs. 1,448.89 per month and a per capita income of Rs. 251.74 per month. The houses were constructed by the Ministry of Rehabilitation and were allotted or sold out to the refugees after independence. These houses are single storeyed but now with the permission of MCD most of the occupants have renovated these houses and have constructed upper floors also.

The social and economic infrastructure of the locality is quite satisfactory. The municipal water supply is available for about 12 hours a day and with high pressure. In this colony people do not have any complaint regarding the inadequacy of water supply. About 14 DTC buses go out of the locality in an hour to different directions. The urban amenities like shopping centre, educational facilities, health services, parks and community centre, etc., are located in close proximity or within the locality. The central business district, *i.e.*, Connaught Place is at a distance of only 4.62 km. and another big shopping complex and a sub-CBD the Ajmal Khan Market and Karol Bagh are only at a distance of 1.18 kms. The locality has an average annual rental value of Rs. 4,992 as against Rs. 2,660 as the assessed rateable value of a property. The notional market value of land is Rs. 500 per sq. metre.

Outram Lines

A residential colony in the north Delhi was established

during 1940's had a population of 17,197 and a density of 35,830 persons per sq. kms., as of 1971 census. The average size of family is 5.57 with an occupancy rate of 3.02 persons per room. The income structure places the residents into the lower and middle income group with an average family income of Rs. 597.50 and a per capita income of Rs. 107.34 per month. The housing structure is of barrack type generally one room tenements with a kitchen which were allotted to the migrant refugees of Pakistan.

The social environmental structure of the locality is quite satisfactory. More than 60 per cent of the households have access to municipal water supply for about 17 hours a day with good pressure. In an hour about 7 buses go out of the locality in different directions but many more buses are available at the other end of the locality namely the Guru Tegh Bahadur Nagar. The urban amenities like shopping centre, educational facilities, health services, etc., are available at a distance of 0.13 km., 0.48 km. and 1.13 km. respectively, but there is no colony or district park in the locality and the community centre is also not there. The central business district (Connaught Place) is at a distance of about 11.33 kms. These environmental conditions have generated an average annual rental value of Rs. 1,116 as against an assessed rateable value of Rs. 150. The notional market value of land is Rs. 300 per sq. metre.

Arya Pura

It is mainly a residential colony in the older part of the city. It has a population of 11,429 and a density of 28,570 persons per sq. km. The average size of the family is 5.50 with an occupancy rate of 2.38 persons per room. The income structure places the residents into the middle and lower income group with an average family income of Rs. 627.50 and a per capita income of Rs. 113.86 per month. The housing construction is very old and dilapidated.

The social environmental condition is not so good although the availability of municipal services is satisfactory. Municipal water supply is available for about 12 hours in a day. About 25 per cent of the heads of household interviewed use public buses for going to the places of employment. A very

good number of buses are also available for going out of the locality in different directions. The urban amenities like shopping centre, educational facilities, health services, parks and playgrounds, community centre, etc., are available at a distance of 0.06 kms., 0.30 km., 0.04 kms., 0.12 km. and 0.08 km. respectively. The central business district (Connaught Place) is at a distance 6.15 kms. These environmental conditions of the locality are responsible for an average annual rental value of Rs. 732 as against an assessed rateable value of Rs. 529 per property. The notional market value of land is about Rs. 700 per sq. metre.

Civil Lines

It is mainly a residential posh locality in the northern part of the city. It has a population of 11,931 and a density of 5,630 persons per sq. km. The colony is on the ridge side and is very neat and clean. The roads are wide and smooth. Although the locality is quite near to the main city but away from the busy shopping complexes of city. The average family size is 5.52 with an occupancy rate of 1.52 persons per room. The income structure places the residents into the higher income group with an average family income of Rs. 4,395.00 per month and a per capita income of Rs. 796.20 per month. The housing construction is of old designs and very big and spacious bungalows are found throughout the colony.

The social and economic environment of the locality is very congenial. The municipal water supply is available for about 18 hours a day. Only 4 per cent of the head of households interviewed use public buses for going to their places of employment and about 9 buses are available for going out of the locality in an hour and many more buses are available at the other end of the locality. The urban amenities like shopping centre, educational facilities, health services, parks and playgrounds, community centre, etc., are available at a distance of 1.27 km., 4.62 km., 0.70 km., 7.02 km. and 0.86 km. respectively. The central business district (Connaught Place) is at a distance of 7.02 km. Within these enviromental Conditions of the locality, the average annual rental value is estimated at Rs. 10,344 as against an assessed rateable value

of Rs. 6,416 per property. The notional market value of land is about Rs. 525 per sq. metre.

Kalkaji

It is mainly a residential colony set up during the post-independence period to rehabilitate the refugees. It had a population of 13,106 and a density of 9,855 persons per sq. km. as of 1971 census. The average family size of 4.94 with an occupancy rate of 1.61 persons per room. The income structure places the residents mainly in the middle income group with an average monthly family income of Rs. 1,317.77 and a per capita income of Rs. 257.73. The housing construction is quite good and most of the houses allotted to the refugees have been renovated and additional floors have also been added.

The social and economic infrastructure of the locality is very good. Due to the coming up of the Nehru Place, its value has increased in terms of economic status. Municipal water supply is available for about 11 hours in a day. More than 50 per cent of the household use public buses for going to their places of employment and about 14 buses are available in an hour for going out of the locality in different directions. The urban amenities like shopping centre, education facilities health services, parks and community centre are available at a distance of 0.26 km., 4.12 km., 0.24 km. 10.03 km. and 0.16 km. respectively. The central business district, *i.e.*, Connaught Place is at a distance of 12.15 kms. The impact of Nehru Place on the market value of land *vis-a-vis* on the property values and their rentals is quite visible but there seems to be no appreciable change in the assessed rateable value of properties. It is evident from an average figure of annual rental value of Rs. 3,972 against the assessed value of Rs. 2,368 per property. Of course, the notional market value is placed at Rs. 450 per sq. metre.

Vasant Vihar

It is mainly a posh residential locality in the Southern part of the city which has come up during the past one decade. In this colony, the land was allotted to the society of the Government Class I officers who have since then constructed

their houses privately. The population of the locality is estimated as 4,967 persons with a density of 3,680 persons per sq. km. The average family size is 3.07 with an occupancy rate of 0.49 persons per room. The income structure places the residents into upper middle and higher income groups with an average family income of Rs. 2,383.33 and a per capita income of Rs. 777.17 per month. The locality has the most ultra modern housing structures.

The social environment of the locality is excellent and loaded with community facilities and urban amenities. The municipal water supply is available only for about 6 hours a day but for such a posh colony it is inadequate. About 7 per cent of the head of households interviewed use public buses for going to their places of employment and about 5 buses go out of the locality in an hour in different directions. The urban amenities like shopping centre, education facilities, parks and community centre are available at a distance of 0.25 km., 3.00 km., 0.15 km. and 0.27 km. respectively. However, the residents are not aware of whether the facility like medical dispensary is available or not in the locality. It is because none of the residents from such a posh colony would like to go to such dispensaries. The two big hospitals of Delhi, *viz.*, Safdarjang and All India Institute of Medical Sciences are at a distance of 3 kms. only. The central business district (Connaught Place) is at a distance of about 9.18 kms. These environmental conditions in the locality have shown tremendous impact on the average rental value of Rs. 25,596 as against an assessed rateable value of Rs. 17,257 per property. The notional market value of land is placed at Rs. 575 per sq. metre.

East Rohtas Nagar

It is a locality with mixed land-use. It is characterised by a number of households and small scale industries stretched all over the residential area which has come up after independence. It has a population of 25,749 and a density of 16,940 persons per sq. km. in 1971. The average family size is 5.09 with an occupancy rate of 1.98 persons per room. The income structure places the residents into low and middle income group with an average family income of

Rs. 676.15 and a per capita income of Rs. 146.07 per month. The housing structure is not very good and the roads are also narrow.

The social and economic infrastructure of the locality is satisfactory but too much congestion on roads. Municipal water supply is available for about 15 hours a-day and with a good pressure. About 45 per cent of the heads of household interviewed use public buses for going to the places of employment. As many as 14 buses are available in an hour for going out of the locality in different directions. The urban amenities like shopping centre, educational facilities, health services, parks, etc., are available at a distance of 0.17 km., 0.34 km. 0.53 km., and 0.31 km., respectively. There is no community centre in the locality as reported by the respondents. The central business district (Connaught Place) is at a distance of about 11.21 kms. In view of these environmental conditions, the locality has an average annual rental value of Rs. 2,532 as against an assessed rateable value of Rs. 1,790 per property. The notional market value of land is about Rs. 175 per sq. metre.

Sadar Cantonment

It is a defence locality with mixed land-uses where a good number of commercial establishments have come up recently. This Sadar Cantonment Area had a civilian population of 25,749 and a density of 1,335 persons per sq. km. as of 1971 census. The average family size is 6.10 with an occupancy rate of 2.80 persons per room. The income structure places the residents in the middle income group with an average family income of Rs. 792.50 and a per capita income of Rs. 129.92 per month. The housing construction is quite old but open, spacious and airy.

The social and economic infrastructure of the locality is quite satisfactory but for the municipal water supply which is available only for about 3 hours a day. Only 10 per cent of the heads of household use public buses for going to their places of employment and about 6 buses are available in an hour for going out of the locality in different directions. Most of the respondents go to their places of employment on foot. The urban amenities like shopping centre, educational facilities,

health services, parks, etc., are available at a distance of 0.06 km., 0.41 km., 0.32 km. and 0.03 km. respectively. There is no community centre in the locality for civilians, as reported by the respondents. The central business district (Connaught Place) is at a distance of about 13.41 kms. The average annual rental value of a property is about Rs. 2,580 as against an assessed rateable value of Rs. 2,936. The notional market value of land is Rs. 200 per sq. metre.

APPENDIX III

QUESTIONNAIRE

Land and Property Values : An Analysis of Environmental Impact

Identification Code Locality House No.

1. Area (in sq.mts.) Land Plinth
2. No. of Storeys .....
3. If more than one storey No. of floors No. of Rooms

I

II

III

IV

4. Tenancy/self-occupied

Floor	Tenancy		
	Owner occupied	Let out	Partly let out
G			
I			
II			
III			
IV			

5. If self-occupied, how much rent would you fetch, if you let out your portion ? Rs.....

6. How much rent do you pay (if tenant) ? Rs.....

7. How much rent do you receive (if owner) ? Rs.....

8. No. of persons living in the house Rs.....

9. Market value of your plot Rs.....

10. What is the assessed rateable value of your property (assessment year 1977) Rs.....

11. How much tax do you pay annually Rs.....

12. Distance of Central Business District (in kms.) .....

13. Could you please give an idea of the road distance of the following amenities from your residence (in kms.)

    13.1. Dispensary .....

    13.2. Primary health centre/family planning centre .....

    13.3. Shopping centre of the locality .....

    13.4. Hospital .....

    13.5. Cinema hall/Theatre .....

    13.6. District park .....

    13.7. Colony park .....

    13.8. Community centre .....

    13.9. College/University .....

NUMBER OF VARIABLES USED FOR CONSTRUCTION OF CORRELATION MATRIX

DEPENDENT VARIABLES

Variables

1. Average rateable value of the property.
2. Average rental value of the property.
3. Average market notional land value (Rs. per sq.metre).

INDEPENDENT VARIABLES

Socio-Economic Environmental Factors

4. Population of the locality.
5. Average monthly family income (in Rs.).
6. Average expenditure on water (Rs. monthly).
7. Average expenditure on electricity (Rs. monthly).
8. Average expenditure on transport (Rs. monthly).
9. Average number of households using public transport.
10. Average number of households using private vehicles. *i.e.*, cars, scooter, etc.

Physical Environmental Factors

11. Number of houses/properties within the locality.
12. Average number of households per property.
13. Average occupancy rate.
14. Density per sq.km. of the locality.
15. Age of the locality.
16. Average number of taps in the house.

Accessibility to Public Utilities and Services

17. Percentage of people having municipal water connection.
18. Average hours of water supply per day.
19. Percentage of households having adequate water supply.
20. Average distance from residence to the place of employment/work (in kms.).
21. Average distance from residence to the nearest railway station (in km.).

22. Total number of buses going out of the locality in an hour to different nodal points.
23. Average total time spent in reaching the place of employment.
24. Average distance from residence to Inter State Bus Terminal (in kms.).

Amenities

25. Average distance a primary school going child has to cover for going to the school.
26. Average distance a secondary school going child has to cover for going to the school.
27. Average distance a college going student has to cover for going to the college.
28. Average time spent by a primary school child for going to the school.
29. Average time spent by a secondary school child for going to the school.
30. Average time spent by a college student for going to the college.
31. Average distance of Central Business District (CBD) from the locality.
32. Average distance of the nearest shopping centre from the residence.
33. Average distance of Sub-Central Business District from the locality.
34. Average distance of district park from the residence.
35. Average distance of cinema hall from the residence.
36. Average distance of dispensary from the residence.
37. Averags distance of the colony park from the residence.
38. Average distance of hospital from the residence.
39. Average distance of community centre from the residence.

APPENDIX V

VARIABLES SELECTED FOR THE SECOND STAGE OF ANALYSIS

Variables

1. Average annual rateable value of property (in Rs.).
2. Average rental value of property (in Rs. annual).
3. Average notional land value (per sq. metre in Rs.)
4. Average monthly family income (in Rs.).
5. Average No. of households per property.
6. Average occupancy rate.
7. Average distance from residence to place of work (in kms)
8. Average no. of buses going out of the locality in an hour to different nodal points.
9. Average distance of CBD (Connaught Place) from the locality (in kms.).
10. Average distance of the nearest shopping centre from the residence (in kms.).
11. Average distance of the colony park.

APPENDIX VI

SUMMARY STATISTICS USED IN THE MODELS

To test the structural stability of the model within the sample, the following summary statistics have been used :

R^2	= Total Coefficient of Determination
$\bar{R}^2$	= Adjusted Coefficient of Determination
$R^2 - \bar{R}^2$	= Adjustment Effect
$R^2 - \sum \frac{Ti^2 (1 - R^2)}{n - k - 1}$	= Multicollinearity effect, where 'n' is the number of observations and k is the number of independent variables.
'F' value	= Test of significance of $\frac{\Delta}{\Delta R^2} R^2$
'T' value	= Test of significance of parameters.
'F' ratio	= Test of significance of R^2

Both the total incrimental contribution as well as the marginal contribution of the variables have been used in the models.

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